SOIL SURVEY OF

Luzerne County, Pennsylvania

United States Department of Agriculture
Soil Conservation Service
in cooperation with
The Pennsylvania State University
College of Agriculture and the
Pennsylvania Department of Environmental Resources
State Conservation Commission

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status or age.

Major field work for this soil survey was completed in the period 1966-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publcation refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service; the Pennsylvania State University, College of Agriculture; and the Pennsylvania Department of Environmental Resources, State Conservation Commission. Financial assistance was provided by the Luzerne County Board of Commissioners and the Department of Housing and Urban Development, under provisions of Section 701 of the Housing Act of 1954 as amended. It is part of the technical assistance furnished to the Luzerne Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Luzerne County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Index to Mapping units" on page ii lists all of the soils in the county by map symbol and shows the page where each soil is described. The capability subclass to which each soil has been assigned is specified at the end of the soil description.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the woodland interpretations.

Foresters and others can refer to the section "Woodland," where the soils of the county are rated according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Luzerne County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover. Area in the Meckesville-Kedron-Leck Kill association, The farm buildings are on Meckesville soils; Leck Kill soils are in the foreground and on the low knoll behind the farm house; Kedron soils are in the right middle ground.

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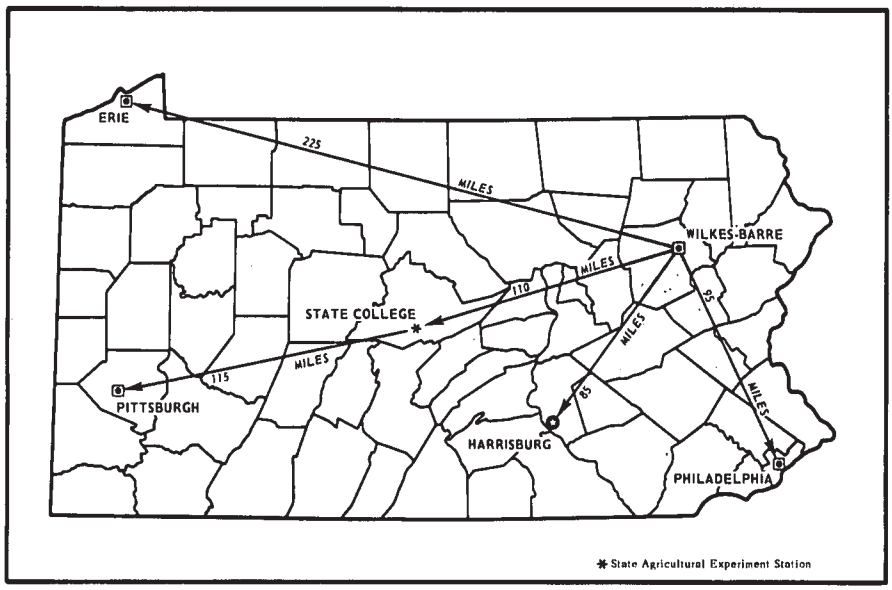

Location of Luzerne County in Pennsylvania.

SOIL SURVEY OF LUZERNE COUNTY, PENNSYLVANIA

By R. Dennis Bush, Soil Conservation Service

Fieldwork by R. Dennis Bush, William L. Braker, Joseph S. Hallowich, Gary W. Martin, Joseph J. Eckenrode, Robert G. Grubb, Donald B. Holzer, Clifford D. Kohler, Garland H. Lipscomb, and George D. Martin

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission

LUZERNE COUNTY is in the northeastern part of Pennsylvania (see facing page), near the western end of the Pocono Mountains resort area. The county has a land area of 886 square miles, or 567,040 acres.

According to the 1970 U.S. Census, the population of Luzerne County was 342,301. About 78 percent of this total lived in urban areas. Three cities in Luzerne County are along the Susquehanna River. Wilkes-Barre, the largest city and the county seat, has a population of 58,856; Nanticoke has a population of 14,632 and Pittston has a population of 11,113. Hazleton, in the southern part of the county, is the second largest city and has a population of 30,426. The discovery of anthracite coal in two major coal fields during the early 1800's led to the concentration of population in the Susquehanna River Valley and the Hazleton area.

Employment in the county is diversified. Manufacturing, the leading industry in numbers employed, accounts for about 40 percent (*10*)[1] of the work force. Of this, over one-third is employed in apparel and textile manufacturing.

Farming is not a major activity in Luzerne County. About 68 percent of the county is in forest, and about 15 percent is in crops and pasture (*10*). Farming is concentrated in four general areas of the county. Dairy farms and a few scattered truck farms and orchards are dominant in the eastern part of the Nescopeck and Wapwallopen watersheds and in the intermountain area north of the Susquehanna River. Truck farming is concentrated on the flood plains and terraces along the Susquehanna River.

Farming has been limited by the many mountain ranges that transect the county and the surface stones that occur in nearly all forested areas. Some forested areas have been or are being developed into community housing sites where the surface stones and rock outcrops enhance the esthetic value of the land.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Luzerne County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Lackawanna and Wellsboro, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Wellsboro channery silt loam, 3 to 8 percent slopes, is one of several phases within the Wellsboro series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a map-

[1]Italic numbers in parentheses refer to Literature Cited, p. 104.

ping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Luzerne County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Arnot-Rock outcrop complex, 0 to 8 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing medium for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this failure to slow permeability or a high water table. They see that streets, road pavements, and foundations for houses crack on a given kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their study and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Luzerne County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soil in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The seven soil associations in Luzerne County are described in the following paragraphs. Most of the names and some of the boundaries on the Luzerne County general soil map do not match those in earlier surveys, for example, those for Carbon and Columbia Counties, because of the changing concept of some series and the differing soil patterns in adjacent areas.

1. Oquaga-Wellsboro-Lackawanna association

Gently sloping to very steep, moderately deep and deep, well drained and moderately well drained soils on dissected plateaus

This association is on broad, dissected plateaus and in broad intermountain basins. The topography is hilly and complex. The soils formed in reddish loamy glacial till derived from red sandstone and shale.

This association, the largest, makes up about 46 percent of the county. It is about 23 percent Oquaga soils (fig. 1), 22 percent Wellsboro soils, 15 percent Lackawanna soils, and 40 percent minor soils.

Oquaga soils, which are mapped only with Lordstown soils, are moderately deep and well drained. They are on the higher ridges and knolls and the steep valley sides formed by streams. In some areas there are narrow, nearly vertical ledges and outcrops of bedrock.

Wellsboro soils occupy plateaus and intermountain basins. They are deep, moderately well drained soils

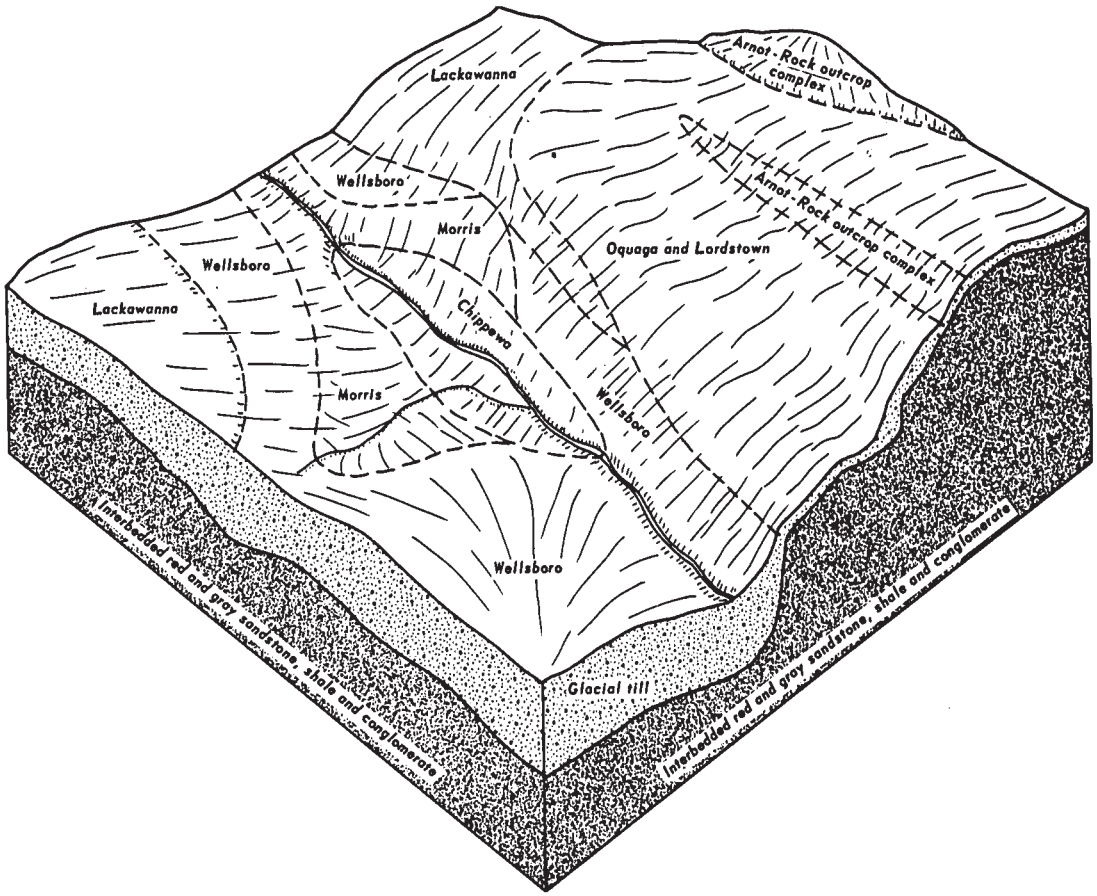

Figure 1.—**Typical pattern of soils and underlying material in association 1.**

with a fragipan, which impedes the movement of roots and water.

Lackawanna soils occupy positions on the landscape similar to those of Wellsboro soils. They are deep and well drained. They also have a fragipan.

Minor in the association are Morris and Chippewa soils in upland depressions and Lordstown and Arnot soils on ridges and knolls.

Dairying is the principal farm enterprise on this association. A few small truck farms are in several areas. Much of the association has been left wooded because of stoniness and impeded drainage of the soils. Most of the State Game Lands in the county are in this association. Some areas that were formerly farmed are idle and are reverting to brush or trees. Areas near small towns and along most main roads are used increasingly for building sites and other development purposes. The depth to bedrock, the restricted permeability, the seasonal high water table, and the stoniness are the major limitations in this association.

2. *Oquaga-Lordstown-Arnot association*

Moderately steep to very steep, moderately deep and shallow, well drained soils on mountain ridges and mountainsides

This association consists of moderately steep to very steep soils on the sides and tops of ridges of the major northeast-southwest trending mountain ranges in the county (fig. 2). The soils formed in red or brown loamy glacial till derived from red or gray sandstone, shale, or conglomerate.

This association makes up about 13 percent of the county. It is about 25 percent Oquaga soils, 20 percent Lordstown soils, 20 percent Arnot soils, and 35 percent minor soils.

Oquaga soils, which are mapped only with Lordstown soils, are moderately deep and well drained. They commonly occupy the lower two-thirds of mountainsides and most narrow ridgetops. The soils on mountainsides are moderately steep to very steep, and those on ridgetops are gently sloping and sloping.

Lordstown soils, which are mapped only with Oquaga soils, are moderately deep and well drained. They are on mountainsides and ridgetops. In some areas there are narrow, nearly vertical ledges and outcrops of bedrock.

Arnot soils are shallow and well drained. The moderately steep to very steep Arnot soils commonly occupy the upper one-third of mountainsides and the highest knolls on narrow, rounded ridgetops. Rock outcrops are common.

Minor in the association are Lackawanna and Wellsboro soils on the lower foot slopes of ridges and Morris and Volusia soils in upland drainageways and depressions.

Because of the extremely stony surface and the steep and very steep slopes, about 90 percent of this association is in woodland. A few of the State Game Lands

Figure 2.—Landscape of association 2 showing the steep sided northeast-southwest trending mountain ranges in the county.

in the county are in this association. The steep slopes and the depth to bedrock are the major limitations in this association.

3. *Strip mine-Mine dump association*

Nearly level to very steep, deep and very shallow soil and rock material on mountaintops and in valleys

This association is on broad mountaintops and mountainsides and in valleys. It consists of exposed bedrock and soil and rock material that was removed to gain access to coal.

This association makes up about 10 percent of the county. It is about 40 percent Strip mine, 10 percent Mine dump, and 50 percent minor soils and land types.

Strip mine consists of areas of exposed bedrock and deep, variably textured soil and rock material that has been excavated and piled. Mine dump is dark colored, variable material separated from coal and piled.

Minor in the association are Pocono, Dekalb, Oquaga, Lordstown, and Wurtsboro soils in undisturbed areas and Mine wash and Urban land in disturbed areas.

Most areas of this association are idle. Small areas are used for building sites and road fill material. A few areas have been reclaimed and revegetated, and a few areas remain in woodland. The hazard of erosion, the slope, the low acidity, and the content of coarse fragments are the major limitations in this association. Many streams have been polluted by mine acid drainage and sediment from unprotected disturbed areas.

4. *Chenango-Pope-Wyoming association*

Nearly level to very steep, deep, well drained and somewhat excessively drained soils on glacial outwash terraces and on flood plains

This association consists of nearly level to sloping soils on glacial outwash terraces; nearly level soils on flood plains; and moderately steep to very steep soils on moraines, kames, and eskers of glacial outwash deposits. These soils formed in loamy to coarse textured glacial outwash deposits derived from reddish and brown upland glacial till.

This association makes up about 9 percent of the county. It is about 30 percent Chenango soils (fig. 3), 15 percent Pope soils, 10 percent Wyoming soils, and 45 percent minor soils.

Chenango soils are deep, well drained soils on outwash terraces and moraines.

Pope soils are nearly level, deep, and well drained. They are on high bottom flood plains. Depth to sand and gravel layers is more than 60 inches.

Wyoming soils are deep and somewhat excessively drained. They are on the sides of eskers and kames.

Minor in this association are Braceville, Rexford, and Atherton soils on glacial outwash terraces and Linden, Holly, Basher, and Wayland soils on flood plains.

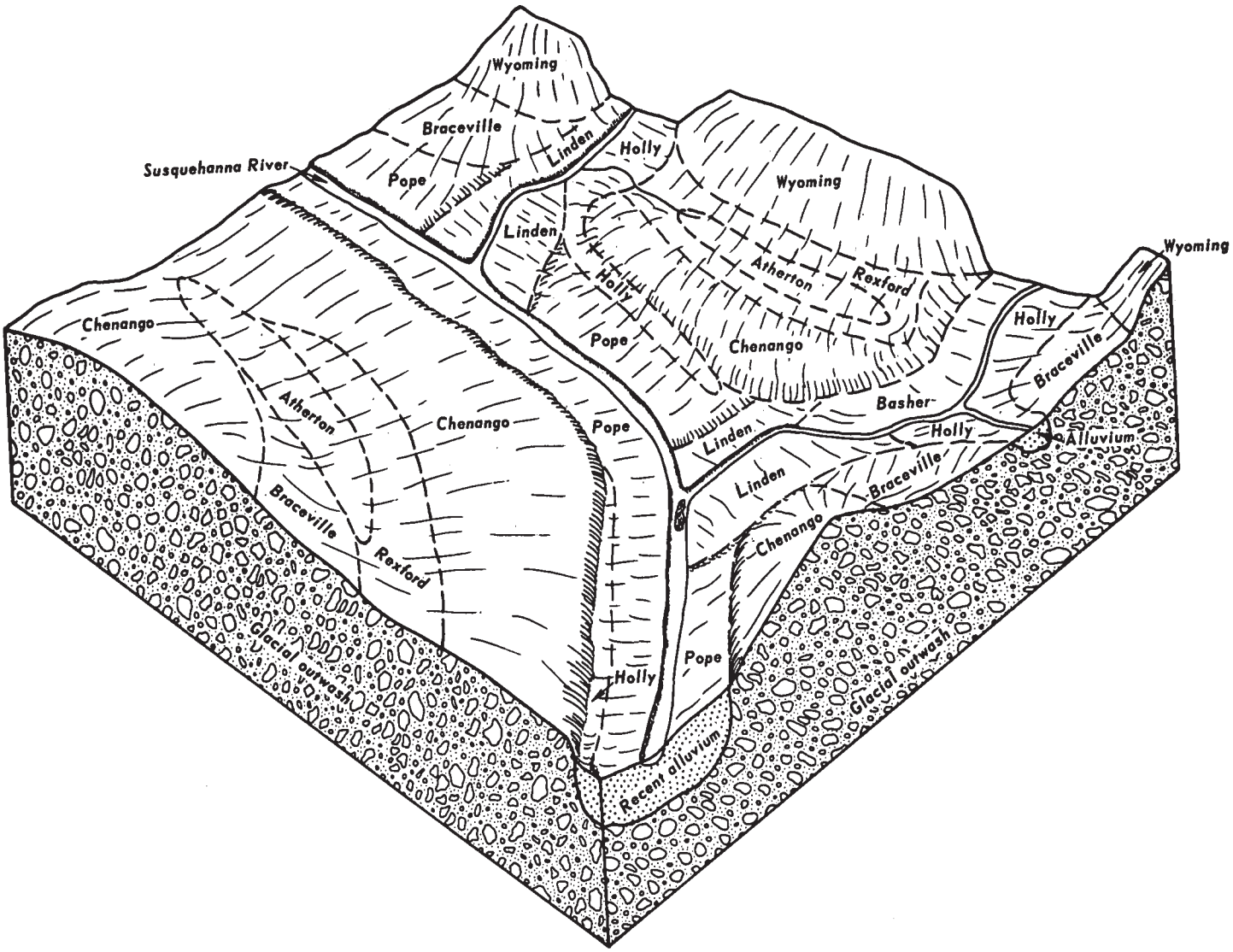

Figure 3.—**Typical pattern of soils and underlying material in association 4.**

Truck cropping is the principal farm enterprise on this association. There are some scattered dairy farms. Some areas are used for building sites and other development purposes. The flood hazard, the slope, the low available water capacity and the hazard of ground water contamination are the major limitations in this association.

5. *Pocono-Dekalb association*

Gently sloping to very steep, deep and moderately deep, well drained soils on mountaintops and ridges

This association consists of gently sloping to moderately steep soils on broad mountaintops and moderately steep to very steep soils on mountainsides and ridgetops. These soils formed in older, brownish loamy glacial till or residuum derived from weathered gray and brown sandstone, conglomerate, and some shale.

This association makes up about 9 percent of the county. It is about 35 percent Pocono soils, 25 percent Dekalb soils, and 40 percent minor soils.

Pocono soils are deep and well drained. They are in high convex positions on mountaintops. Nearly all areas of Pocono soils have an extremely stony surface layer.

Dekalb soils are moderately deep and well drained. They occupy ridgetops and knolls. They have an extremely stony surface layer. Narrow, nearly vertical ledges and outcrops of bedrock are common.

Minor in this association are Buchanan, Alvira, and Shelmadine soils in the lower lying positions and mine spoils in areas where coal has been removed.

Most areas of this association are in woodland. Some areas are in urban use, and others have been strip mined. The depth to bedrock and the extremely stony surface layer are the major limitations in this association.

6. *Lordstown-Mardin-Volusia association*

Gently sloping to very steep, deep and moderately deep, well drained to somewhat poorly drained soils on dissected plateaus

This association is on broad, dissected plateaus and in broad intermountain basins. The topography is hilly and complex. The soils formed in brownish loamy glacial till derived from red and gray sandstone, shale, and conglomerate.

This association makes up about 8 percent of the county. It is about 25 percent Lordstown soils, 25 percent Mardin soils, 10 percent Volusia soils, and 40 percent minor soils.

Lordstown soils, which are mapped only with Oquaga soils, are moderately deep and well drained. They are on the higher ridges and knolls. In some areas there are narrow, nearly vertical ledges and outcrops of bedrock.

Mardin soils are in the lower lying areas adjacent to Lordstown soils. They are deep and moderately well drained soils with a fragipan, which impedes the movement of roots and water.

Volusia soils are in the low lying areas in intermountain basins and upland depressions. They are deep and somewhat poorly drained soils with a fragipan.

Minor in the association are Arnot and Oquaga soils on ridges and knolls, Bath soils in lower lying areas, and Chippewa soils and Muck in the lowest positions of the landscape.

Dairying is the principal farm enterprise on this association. Much of the association has been left wooded because of stoniness and impeded drainage of the soils. Some areas that were formerly farmed are idle and are reverting to brush and trees. Areas near small towns and along most main roads are used increasingly for building sites and other development purposes. The depth to bedrock, the restricted permeability, the seasonal high water table, and the stoniness are the major limitations in this association.

7. *Meckesville-Kedron-Leck Kill association*

Gently sloping to moderately steep, deep, well drained and moderately well drained soils in upland valleys

This association consists of gently sloping to sloping soils on uplands and some moderately steep soils on hillsides adjacent to stream channels. The soils formed in reddish glacial till derived from red and brown sandstone and shale.

This association makes up about 5 percent of the county. It is about 43 percent Meckesville soils (fig. 4), 18 percent Kedron soils, 15 percent Leck Kill soils, and 24 percent minor soils.

Meckesville soils are deep, well drained loamy soils that have a fragipan. They are on the smooth convex higher upland positions. The fragipan impedes the movement of roots and water, but the soil is not saturated long enough to interfere with crops.

Kedron soils are in lower lying, slightly concave areas. They are deep, moderately well drained soils that also have a fragipan.

Leck Kill soils are on the broad upland plateaus and hillsides. They are deep, well drained soils that do not have a fragipan.

Minor in this association are Klinesville soils on ridges and knolls, somewhat poorly drained Kedron soils in upland depressions, and Basher and Holly soils on flood plains.

Dairying is the principal farm enterprise on this association. Some truck farming is done in scattered areas. Some areas near the foot slopes of mountain ranges are idle and are reverting to brush and trees. Many areas are used increasingly for building sites and for other development purposes. The restricted permeability and the seasonal high water table are the major limitations in this association.

Descriptions of the Soils

In this section the soils of Luzerne County are described in detail and their use and management is discussed. Each soil series is described in detail and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward into the parent material or to rock. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for moist soil unless otherwise stated. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land and Mine dump, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol which identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability subclass in which the mapping unit has been placed. The capability subclasses are described on page 49.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).

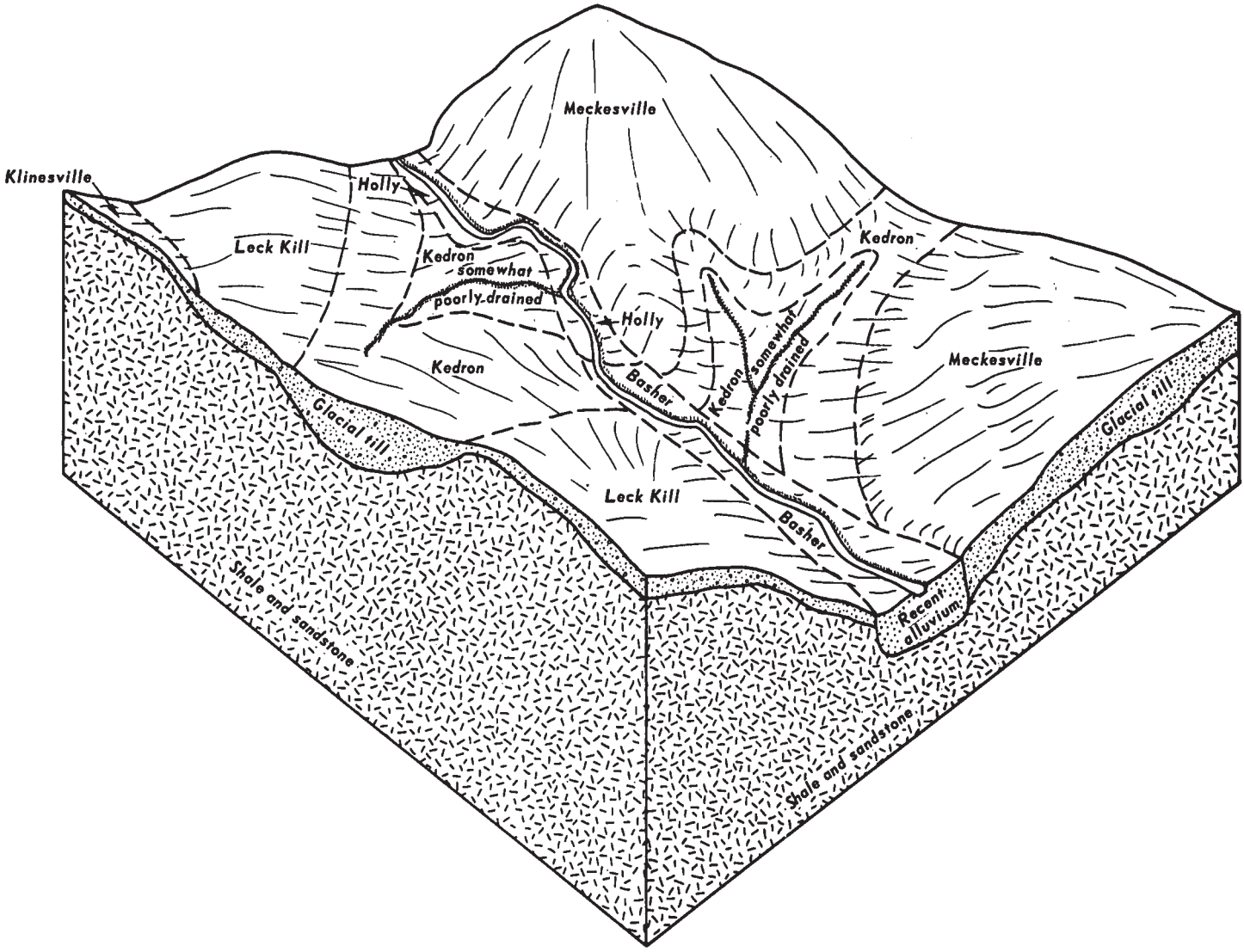

Figure 4.—Typical pattern of soils and underlying material in association 7.

Alluvial Land

Ag—Alluvial land is a nearly level to gently sloping, unconsolidated mixture of variably textured soil material, gravel, cobbles, and stones. It occurs on narrow flood plains and in upland drainageways, and forms alluvial fans at the mouths of drainageways. Typically, the deposits are not old enough for soil horizons to have developed. Drainage is variable, and shallow pools are common after flooding and heavy rainfall. Included in mapping are a few small areas of Basher, Holly, and Wayland soils.

Because of variable drainage, the flood hazard, and the stony and cobbly surface layer, Alluvial land is generally not suited to farming. Because it is flooded frequently, it is poorly suited to most nonfarm uses. It is best suited to woodland, wildlife habitat, recreation, and esthetic use.

Alvira Series

The Alvira series consists of deep, somewhat poorly drained, nearly level to gently sloping soils. These soils are on broad, rolling mountaintops and at the base of mountains in upland depressions and drainageways. They formed in thick, glacially influenced material derived from sandstone, conglomerate, and shale.

The top 3 inches in a representative profile is an organic layer of undecomposed and partly decomposed leaf litter. The surface layer is about 3 inches of very dark grayish brown silt loam. The subsurface layer is 2 inches of light brownish gray silt loam. The upper 17 inches of the subsoil is mottled yellowish brown and light brownish gray channery silt loam and channery silty clay loam. The lower part to a depth of 60 inches or more is firm and brittle, mottled strong brown and yellowish red channery clay loam.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Alluvial land	1,190	0.2
Alvira silt loam, 3 to 8 percent slopes	260	(1)
Alvira very stony silt loam, 0 to 8 percent slopes	1,285	.2
Arnot-Rock outcrop complex, 0 to 8 percent slopes	5,945	1.0
Arnot-Rock outcrop complex, 8 to 25 percent slopes	10,870	1.9
Arnot-Rock outcrop complex, steep	16,220	2.8
Atherton silty loam, gray subsoil variant	835	.1
Basher soils	3,815	.7
Bath channery silt loam, 3 to 8 percent slopes	1,090	.2
Bath channery silt loam, 8 to 15 percent slopes	1,010	.2
Bath channery silt loam, 15 to 25 percent slopes	715	.1
Bath very stony silt loam, 3 to 8 percent slopes	415	.1
Bath very stony silt loam, 8 to 25 percent slopes	1,040	.2
Braceville gravelly loam, 0 to 3 percent slopes	390	.1
Braceville gravelly loam, 3 to 8 percent slopes	3,225	.6
Braceville gravelly loam, 8 to 15 percent slopes	1,205	.2
Buchanan channery loam, 3 to 8 percent slopes	920	.2
Buchanan extremely stony loam, 3 to 8 percent slopes	4,300	.8
Buchanan extremely stony loam, 8 to 25 percent slopes	885	.1
Chenango gravelly loam, 0 to 3 percent slopes	2,590	.5
Chenango gravelly loam, 3 to 8 percent slopes	8,395	1.5
Chenango gravelly loam, 8 to 15 percent slopes	4,895	.9
Chippewa silt loam, 0 to 3 percent slopes	5,995	1.1
Chippewa silt loam, 3 to 8 percent slopes	2,190	.4
Chippewa very stony silt loam, 0 to 8 percent slopes	8,935	1.6
Dekalb extremely stony sandy loam, 0 to 8 percent slopes	4,195	.7
Dekalb extremely stony sandy loam, 8 to 25 percent slopes	6,270	1.1
Dekalb extremely stony sandy loam, steep	5,675	1.0
Holly silt loam	3,330	.6
Kedron channery silt loam, 3 to 8 percent slopes	3,110	.5
Kedron channery silt loam, 8 to 15 percent slopes	745	.1
Kedron very stony silt loam, 3 to 8 percent slopes	850	.1
Kedron very stony silt loam, 8 to 20 percent slopes	370	.1
Kedron channery silt loam, somewhat poorly drained, 0 to 8 percent slopes	1,155	.2
Kedron very stony silt loam, somewhat poorly drained, 0 to 8 percent slopes	270	(1)
Lackawanna channery silt loam, 3 to 8 percent slopes	6,510	1.1
Lackawanna channery silt loam, 8 to 15 percent slopes	5,215	1.0
Lackawanna channery silt loam, 15 to 25 percent slopes	1,760	.3
Lackawanna very stony silt loam, 3 to 8 percent slopes	11,770	2.1
Lackawanna very stony silt loam, 8 to 25 percent slopes	19,330	3.4
Lackawanna and Bath very stony silt loams, steep	3,415	.6
Leck Kill channery silt loam, 3 to 8 percent slopes	2,085	.4
Leck Kill channery silt loam, 8 to 15 percent slopes	2,165	.4
Leck Kill channery silt loam, 15 to 25 percent slopes	1,120	.2
Linden soils	3,725	.6
Mardin channery silt loam, 3 to 8 percent slopes	5,935	1.0
Mardin channery silt loam, 8 to 15 percent slopes	4,475	.8
Mardin channery silt loam, 15 to 25 percent slopes	625	.1
Mardin very stony silt loam, 3 to 8 percent slopes	2,955	.5
Mardin very stony silt loam, 8 to 25 percent slopes	2,880	.5
Meckesville channery silt loam, 3 to 8 percent slopes	7,565	1.3
Meckesville channery silt loam, 8 to 15 percent slopes	2,985	.5
Meckesville channery silt loam, 15 to 25 percent slopes	720	.1
Meckesville very stony silt loam, 3 to 8 percent slopes	600	.1
Meckesville very stony silt loam, 8 to 25 percent slopes	1,085	0.2
Mine dump	5,930	1.0
Mine dump, burned	690	.1
Mine wash	945	.2
Morris channery silt loam, 0 to 8 percent slopes	7,250	1.3
Morris channery silt loam, 8 to 15 percent slopes	1,430	.3
Morris very stony silt loam, 0 to 8 percent slopes	15,060	2.7
Morris very stony silt loam, 8 to 15 percent slopes	1,350	.2
Muck	2,585	.5
Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes	12,030	2.1
Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes	13,490	2.4
Oquaga and Lordstown channery silt loams, 15 to 25 percent slopes	7,880	1.4
Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes	21,005	3.7
Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes	50,410	8.9
Oquaga and Lordstown extremely stony silt loams, steep	46,800	8.2
Pocono gravelly sandy loam, 3 to 8 percent slopes	2,655	.5
Pocono gravelly sandy loam, 8 to 15 percent slopes	505	.1
Pocono extremely stony sandy loam, 3 to 8 percent slopes	10,735	1.9
Pocono extremely stony sandy loam, 8 to 25 percent slopes	7,790	1.4
Pope soils	7,935	1.4
Rexford loam, 0 to 3 percent slopes	1,175	.2
Rexford loam, 3 to 8 percent slopes	2,145	.4
Shelmadine silt loam, 0 to 5 percent slopes	300	.1
Shelmadine very stony silt loam, 0 to 5 percent slopes	1,290	.2
Strip mine	25,270	4.5
Urban land	1,020	.2
Urban land, rarely flooded	890	.2
Volusia channery silt loam, 0 to 8 percent slopes	3,580	.6
Volusia channery silt loam, 8 to 15 percent slopes	910	.2
Volusia very stony silt loam, 0 to 8 percent slopes	3,270	.6
Volusia very stony silt loam, 8 to 15 percent slopes	690	.1
Wayland silt loam	1,570	.3
Weikert and Klinesville channery silt loams, 3 to 8 percent slopes	450	.1
Weikert and Klinesville channery silt loams, 8 to 15 percent slopes	640	.1
Weikert and Klinesville channery silt loams, 15 to 25 percent slopes	460	.1
Wellsboro channery silt loam, 3 to 8 percent slopes	17,130	3.0
Wellsboro channery silt loam, 8 to 15 percent slopes	10,785	1.9
Wellsboro channery silt loam, 15 to 25 percent slopes	2,320	.4
Wellsboro very stony silt loam, 3 to 8 percent slopes	31,980	5.6
Wellsboro very stony silt loam, 8 to 25 percent slopes	14,120	2.5
Wurtsboro channery loam, 3 to 8 percent slopes	3,475	.6
Wurtsboro channery loam, 8 to 15 percent slopes	2,185	.4
Wurtsboro channery loam, 15 to 25 percent slopes	355	.1
Wurtsboro extremely stony loam, 3 to 8 percent slopes	4,285	.7
Wurtsboro extremely stony loam, 8 to 25 percent slopes	3,045	.5
Wyoming gravelly loam, 15 to 25 percent slopes	2,720	.5
Wyoming gravelly loam, 25 to 60 percent slopes	2,405	.4
Cut and fill land	7,405	1.3
Pits and quarries	1,160	.2
Bodies of water 2 to 40 acres in size	2,030	.4
Total	567,040	100.0

[1]Less than 0.5 percent.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow in the fragipan. Available water capacity is moderate. The seasonal high water table is within a depth of 6 to 18 inches during wet periods.

Representative profile of Alvira silt loam, in an area of Alvira very stony silt loam, 0 to 8 percent slopes, in a wooded area in Hazle Township about 2 miles northeast of the village of Stockton:

O1—3 inches to 1 inch; recently deposited leaf litter.
O2—1 inch to 0; dark reddish brown (5YR 2/2) partly decomposed organic materials.
A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam; weak very fine granular structure; very friable, nonsticky, nonplastic; many small and medium roots; 10 percent coarse fragments; extremely acid; abrupt smooth boundary.
A2—3 to 5 inches; light brownish gray (10YR 6/2) silt loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; many small and medium roots; 10 percent coarse fragments; extremely acid; clear wavy boundary.
B1—5 to 8 inches; yellowish brown (10YR 5/4) channery silt loam; common coarse distinct light gray (10YR 7/1) and strong brown (7.5YR 5/8) mottles; weak fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic; abundant small and medium roots; few fine black (N 2/0) coatings on ped faces; 15 percent coarse fragments; extremely acid; gradual wavy boundary.
B21t—8 to 14 inches; yellowish brown (10YR 5/4) ped faces and yellowish brown (10YR 5/8) ped interiors, channery silty clay loam; weak medium subangular blocky structure; friable, sticky, plastic; abundant small and medium roots; 15 percent coarse fragments; thin continuous clay films on ped faces; extremely acid; gradual wavy boundary.
B22gt—14 to 22 inches; light brownish gray (10YR 6/2) channery silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable, sticky, plastic; few small roots; 15 percent coarse fragments; thin discontinuous clay films around stone faces and on some ped faces; extremely acid; gradual wavy boundary.
Bx1—22 to 28 inches; strong brown (7.5YR 5/6) channery clay loam, light brownish gray (10YR 6/2) prism faces; few medium distinct yellowish brown (10YR 5/8) and yellowish red (5YR 5/8) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; firm and brittle, sticky, plastic; few fine roots along prism faces; 20 percent coarse fragments; thin discontinuous clay films on prism faces; extremely acid; gradual wavy boundary.
Bx2—28 to 60 inches; yellowish red (5YR 5/6) channery clay loam, pinkish gray (7.5YR 6/2) prism faces; weak very coarse prismatic structure parting to weak coarse subangular blocky; firm and brittle, sticky, plastic; few fine roots along prism faces; 25 percent coarse fragments; thin discontinuous clay films along prism faces; common fine black (N 2/0) coatings on ped faces; strongly acid.

Solum thickness ranges from 40 to 80 inches. Depth to the Bx horizon ranges from 16 to 28 inches, and depth to bedrock is 5 feet or more. The content of coarse fragments ranges from 5 to 25 percent above the Bx horizon and from 5 to 50 percent in the Bx horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout the profile. Color in the B1 horizon ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6) with grayish or brownish mottles. Color in the B2t horizon ranges from light gray (10YR 7/1) to strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2), and the dominant chroma is 2 or less on ped face coatings. The fine earth texture of the B1 and B2t horizons is silt loam or silty clay loam. Prism faces in the Bx horizon range from light gray (5Y 6/1, N 7/0) to pinkish gray (7.5YR 6/2). Prism interiors range from grayish brown (10YR 5/2) to yellowish red (5YR 5/6) and have gray and brown mottles. The fine earth texture of the Bx horizon ranges from loam to silty loam or clay loam.

Alvira, Shelmadine, Buchanan, and Pocono soils formed in similar material. Alvira soils are somewhat poorly drained, Shelmadine soils are poorly drained, Buchanan soils are moderately well drained, and Pocono soils are well drained.

A1B—Alvira silt loam, 3 to 8 percent slopes. This gently sloping soil is in low lying areas, in depressions, and in upland drainageways between the steeper, better drained soils and the lower lying, more poorly drained soils. Runoff is slow, and the hazard of erosion is moderate.

Included with this soil in mapping are a few small areas of Alvira very stony silt loam and a few small areas of poorly drained and very poorly drained soils.

This Alvira soil is medium to low in natural fertility and low in content of organic matter. The seasonal high water table delays tillage during wet periods. Diversion terraces or artificial drains are needed to remove excess water and improve use and management. Stripcropping is needed to control erosion.

Most areas of this soil are in woodland. A few small areas have been used as building sites. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability in the subsoil. Capability subclass IIIw.

AnB—Alvira very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in low lying areas, in depressions, and in upland drainageways between the steeper, better drained soils and the lower lying, more poorly drained soils. The surface area is 1 to 10 percent stones and boulders. Runoff is slow, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Alvira silt loam. Also included are a few small areas southwest of Eckley where the soils have a higher percentage of quartzite gravel fragments and sand throughout the profile.

This Alvira soil is medium to low in natural fertility and moderate to low in content of organic matter. Because of the surface stones, it is not suited to cultivated crops. It is better suited to permanent pasture, woodland, and wildlife habitat. The seasonal high water table restricts the use of some woodland equipment during wet periods.

Most areas of this soil are in woodland. Most limitations for nonfarm use are related to the very stony surface layer, the seasonal high water table, and the slow permeability in the subsoil. Capability subclass VIs.

Arnot Series

The Arnot series consists of shallow, well drained, nearly level to steep soils. These soils are on the convex tops and sides of hills, knolls, and mountain ridges.

They formed in thin glacial till material derived from sandstone, conglomerate, and shale.

The top half inch in a representative profile is an organic layer of leaf litter. The surface layer is 3 inches of very dark brown flaggy silt loam. The subsoil is yellowish brown channery silt loam about 14 inches thick. Fractured gray sandstone and shale bedrock is at a depth of 17 inches.

Permeability is moderate, and available water capacity is very low.

Representative profile of Arnot flaggy silt loam in a wooded area of Arnot-Rock outcrop complex, 0 to 8 percent slopes, in Pittston Township about 2 miles southeast of Dupont:

O1—½ inch to 0; partly decomposed hardwood leaf litter.
A1—0 to 3 inches; very dark brown (10YR 2/2) flaggy silt loam; weak fine granular structure; friable, nonsticky, nonplastic; many fine and medium roots; 30 percent coarse fragments as large as 12 inches in diameter; very strongly acid; abrupt smooth boundary.
B2—3 to 17 inches; yellowish brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; many fine and medium roots; 40 percent coarse fragments; strongly acid; abrupt smooth boundary.
R—17 inches; fractured gray sandstone and shale bedrock.

Solum thickness and depth to bedrock range from 10 to 20 inches. The content of coarse fragments ranges from 35 to 50 percent in the B horizon and in the C horizon where it occurs. The fine earth texture in the solum is silt loam or loam. Reaction ranges from extremely acid to strongly acid throughout. Some pedons have a pinkish gray to light brownish gray A2 horizon 1 to 2 inches thick. Color in the B horizon ranges from reddish brown (5YR 4/3) through light olive brown (2.5Y 5/4). Some pedons have a thin C horizon.

Arnot, Oquaga, Lordstown, and Dekalb soils formed in similar material. Arnot soils are shallower than Oquaga, Lordstown, and Dekalb soils and have a finer textured B2 horizon than Dekalb soils.

ArB—Arnot-Rock outcrop complex, 0 to 8 percent slopes. This nearly level to gently sloping mapping unit is on convex mountain ridgetops, hills, and knolls. It is about 70 percent Arnot soil and 15 percent Rock outcrop. Loose stones cover up to 25 percent of the surface. Runoff is slow, and the hazard of erosion is slight.

The Arnot soil has the profile described as representative of the series. The Rock outcrop part of the unit is large areas of exposed bedrock.

Included with this unit in mapping are a few small areas where more than 25 percent of the surface is covered with stones and boulders.

Natural fertility and content of organic matter are low. Because of the stones and rock outcrop, this unit is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, and esthetic uses.

Most areas are wooded. The very stony to extremely stony surface layer and the rock outcrop restrict the use of some woodland equipment. Most limitations for nonfarm use are related to the depth to bedrock, the surface stones, and the rock outcrop. Capability subclass VIIs.

ArD—Arnot-Rock outcrop complex, 8 to 25 percent slopes. This sloping to moderately steep mapping unit is on convex ridgetops and on mountainsides and hillsides. It is about 55 percent Arnot soil and about 30 percent Rock outcrop. Loose stones and boulders cover up to 30 percent of the surface. Runoff is slow to medium, and the hazard of erosion is slight.

The Arnot soil has a profile similar to the one described as representative of the series, but depth to bedrock is about 15 inches. The Rock outcrop part of the unit is large areas of exposed bedrock.

Included with this unit in mapping are a few small areas of Oquaga, Lordstown, and Dekalb soils. Also included are a few small areas of Rock outcrop and nearly vertical rock ledges, areas of soils where slopes are more than 25 percent, and areas of Arnot soils where more than 30 percent of the surface is covered with stones.

Natural fertility and content of organic matter are low. Because of the surface stones and rock outcrop, this unit is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, and esthetic use.

Most areas are wooded. The very stony to extremely stony surface layer and the rock outcrop restrict the use of some woodland equipment. Most limitations for nonfarm use are related to slope, the depth to bedrock, the surface stones, and the rock outcrop. Capability subclass VIIs.

ASF—Arnot-Rock outcrop complex, steep. This steep and very steep mapping unit is on convex mountainsides and hillsides. It is about 55 percent Arnot soil and 30 percent Rock outcrop. Loose stones and boulders cover from 3 to 40 percent of the surface. Runoff is rapid, and the hazard of erosion is slight.

The Arnot soil has a profile similar to the one described as representative of the series, but depth to bedrock is about 12 inches. The Rock outcrop part of the unit is large areas of exposed bedrock.

Because of the steep and very steep slopes, this mapping unit has not been investigated as thoroughly as the less sloping Arnot-Rock outcrop mapping units, and it contains more inclusions than those units.

Natural fertility and content of organic matter are low. Because of steep slopes, this unit is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, and esthetic uses.

Most areas of this soil are in woodland. The steep and very steep slopes restrict the use of some woodland equipment. Most limitations for nonfarm use are related to slope, the stones, the rock outcrop, and the depth to bedrock. Capability subclass VIIs.

Atherton Variant

The Atherton variant consists of deep, poorly drained and very poorly drained, nearly level soils. These soils are in low lying depressions on glacial outwash terraces. They formed in thick sediments derived from glacial ice deposits.

The top 2 inches in a representative profile is an

organic layer of undecomposed and partly decomposed leaf litter. The surface layer is about 6 inches of faintly mottled dark gray silt loam. The upper 25 inches of the subsoil is mottled light gray silt loam, and the lower 6 inches is dark gray silty clay. The substratum to a depth of 60 inches is 17 inches of gray very fine sand and sand and 6 inches of dark grayish brown very gravelly sand.

Permeability is slow, and available water capacity is moderate to high. The seasonal high water table is at or near the surface during wet periods.

Representative profile of Atherton silt loam, gray subsoil variant, in Salem Township about 1½ miles northeast of the village of Beach Haven:

O1—2 inches to 1 inch; recently deposited leaf litter.

O2—1 inch to 0; partly decomposed leaf and plant material.

A1—0 to 6 inches; dark gray (10YR 4/1) silt loam, light gray (10YR 7/1) rubbed and dry; few fine faint pale brown (10YR 6/3) mottles and few fine prominent yellowish red (5YR 5/8) root stains; weak fine granular structure; very friable, nonsticky, nonplastic; many fine and medium roots; less than 1 percent gravel; strongly acid; abrupt wavy boundary.

B21g—6 to 16 inches; light gray (10YR 6/1) silt loam; common fine and medium distinct strong brown (7.5YR 5/6) and yellowish red (5YR 5/6) mottles and stains around root pores; weak medium and thick platy structure parting to weak fine and very fine blocky; friable, nonsticky, slightly plastic; few fine and medium roots; less than 1 percent rounded gravel; strongly acid; gradual wavy boundary.

B22g—16 to 31 inches; light gray (10YR 6/1) silt loam; common fine and medium prominent yellowish red (5YR 5/6) mottles and stains around root pores; weak medium and coarse subangular blocky structure; friable to slightly firm, nonsticky, slightly plastic; few fine and medium roots; less than 1 percent gravel; strongly acid; clear wavy boundary.

B23g—31 to 37 inches; dark gray (10YR 4/1) silty clay loam; common fine and medium distinct strong brown (7.5YR 5/6) and very dark gray (N 3/0) mottles in prism interiors; weak medium prismatic structure parting to weak medium and coarse subangular blocky; friable to slightly firm, slightly sticky, plastic; fine and medium roots; less than 1 percent gravel; strongly acid; clear wavy boundary.

IIC1g—37 to 47 inches; about 75 percent gray (10YR 5/1) and about 25 percent dark brown (7.5YR 4/4) very fine sand; massive; very friable, nonsticky, nonplastic; less than 5 percent gravel; slightly acid; gradual wavy boundary.

IIC2g—47 to 54 inches; about 75 percent gray (10YR 5/1) and about 25 percent dark brown (7.5YR 4/4) sand that has long narrow horizontal streaks of very dark gray (N 3/0); massive; very friable, nonsticky, nonplastic; less than 5 percent gravel; slightly acid; gradual wavy boundary.

IIC3g—54 to 60 inches; dark grayish brown (10YR 4/2) very gravelly sand; massive; loose, nonsticky, nonplastic; 55 percent gravel that is ¼ to ¾ inch in diameter; slightly acid.

Solum thickness ranges from 24 to 40 inches. Depth to bedrock is 6 feet or more. The content of coarse fragments ranges from 0 to 20 percent in the solum. In unlimed areas reaction ranges from strongly acid to medium acid in the solum and from medium acid to slightly acid in the substratum. Color in the B2g horizon ranges from dark gray (N 4/0) or (5Y 4/1) to pinkish gray (5YR 6/2) and is mottled in most pedons. The texture of the fine earth fraction ranges from loam to silty clay loam. Color in the C horizon is similar to that in the B2g horizon. Gravelly sand is intermingled with a few thin layers of sand to silty clay loam with or without gravel. The thin layers of finer textured material make up no more than 5 percent of the volume.

The Atherton variant has grayer colors throughout the subsoil than is defined for the Atherton series, but these differences do not alter use, management, or behavior.

The Atherton variant and Rexford, Braceville, Wyoming, and Chenango soils formed in similar material. Rexford and Braceville soils have a fragipan, and Wyoming and Chenango soils do not. The Atherton variant is poorly drained and very poorly drained, Rexford soils are somewhat poorly drained and poorly drained, Braceville soils are moderately well drained, Wyoming soils are somewhat excessively drained, and Chenango soils are well drained.

At—Atherton silt loam, gray subsoil variant. This is a nearly level soil in low lying, uniformly concave positions. It receives much runoff from adjacent areas. Slopes are 0 to 3 percent. Runoff is very slow, ponding is common, and the hazard of erosion is slight.

Included with this soil in mapping are a few small areas of Rexford, Braceville, and Chenango soils. Also included, east of New Columbus, are a few small areas of soils that have similar drainage and parent material and a fragipan at a depth of 20 to 22 inches.

This Atherton soil is medium in natural fertility and moderate in content of organic matter. The seasonal high water table delays tillage during spring or wet periods. Artificial drainage is needed to improve use and management if this soil is used for cultivated crops. Diversion terraces are needed to divert runoff from some surrounding areas.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are either in woodland or are left idle. A few small areas are used for permanent pasture. Most limitations for nonfarm use are related to the high water table, the slow permeability, and ponding. Capability subclass IVw.

Basher Series

The Basher series consists of deep, moderately well drained and somewhat poorly drained, nearly level soils on flood plains. These soils formed in mixed alluvial material deposited by streams.

In a representative profile, the surface layer is dark reddish brown silt loam about 6 inches thick. The subsurface layer is reddish brown loam about 4 inches thick. The upper 14 inches of the subsoil is reddish brown loam, and the lower 13 inches is brown fine sandy loam. The substratum to a depth of 62 inches is 10 inches of reddish brown fine sandy loam, 6 inches of reddish gray fine sandy loam, and 9 inches of reddish gray very gravelly sand.

Permeability is moderate, and available water capacity is high. These soils are subject to occasional to frequent flooding.

Representative profile of Basher silt loam, in an area of Basher soils, in Sugarloaf Township near Little Nescopeck Creek about a half mile north of Sybertsville:

Ap—0 to 6 inches; dark reddish brown (5YR 3/2) silt loam; weak fine granular structure; very friable, slightly sticky, slightly plastic; many small roots; extremely acid; abrupt smooth boundary.

A2—6 to 10 inches; reddish brown (5YR 4/4) loam; few medium faint dark reddish brown (5YR 3/2) organic stains and few fine faint yellowish red (5YR 4/6) mottles and bleached sand lenses; weak thin platy structure; very friable, nonsticky, slightly plastic; abundant small roots; extremely acid; gradual wavy boundary.

B21—10 to 18 inches; reddish brown (5YR 4/3) loam; few fine faint yellowish red (5YR 4/8) mottles; weak fine and medium subangular blocky structure; friable, nonsticky, slightly plastic; many small roots; thin continuous silt films in root channels; extremely acid; gradual wavy boundary.

B22—18 to 24 inches; reddish brown (5YR 5/3) loam; common medium distinct pinkish gray (5YR 6/2) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable, nonsticky, slightly plastic; many small roots; few fine black (N 2/0) concretions; thin continuous clay films in root channels; extremely acid; gradual wavy boundary.

B3—24 to 37 inches; brown (7.5YR 5/4) fine sandy loam; common medium prominent pinkish gray (5YR 6/2) and yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; firm, nonsticky, slightly plastic; few small roots; few fine black (N 2/0) concretions; few thin continuous clay films in root channels; extremely acid; gradual wavy boundary.

C1—37 to 47 inches; reddish brown (5YR 5/4) fine sandy loam prism interior, light gray (5YR 7/1) prism face; common medium faint yellowish red (5YR 4/8) mottles in prism interior; moderate coarse prismatic structure parting to weak very thick platy; firm, nonsticky, nonplastic; 2 percent rounded gravel; few small roots; very strongly acid; gradual wavy boundary.

C2—47 to 53 inches; reddish gray (5YR 5/2) fine sandy loam; many medium distinct yellowish red (5YR 5/8) mottles; massive; friable to slightly firm, nonsticky, nonplastic; 2 percent rounded gravel; few small roots; few medium and fine black (N 2/0) concretions; very strongly acid; clear wavy boundary.

IIC3—53 to 62 inches; reddish gray (5YR 5/2) very gravelly sand and many bleached white coarse sand grains; massive; very friable, nonsticky, nonplastic; 55 percent gravel; very strongly acid.

Solum thickness ranges from 24 to 40 inches. Reaction ranges from extremely acid to strongly acid in the A and B horizons and from very strongly acid to medium acid in the C and IIC horizons. The content of coarse fragments ranges from 0 to 15 percent above a depth of 40 inches and from 0 to 60 percent below. Texture ranges from silt loam or loam to fine sandy loam in all horizons above a depth of 40 inches and to sand in the fine earth fraction below 40 inches. Mottles with a chroma of 2 or less are at a depth of 15 to 24 inches. Color in the B2 horizon ranges from dark reddish brown (2.5YR 3/4) or (5YR 3/3) to yellowish red (5YR 5/6). Color in the B3 horizon ranges from reddish brown (2.5YR 5/4) to dark brown (7.5YR 4/4). Color in the C horizon ranges from dark reddish brown (5YR 3/2) to yellowish brown (10YR 5/4).

Basher, Linden, Pope, Holly, and Wayland soils formed in similar material. Basher soils are moderately well drained and somewhat poorly drained, Linden and Pope soils are well drained, Holly soils are poorly drained, and Wayland soils are very poorly drained.

Bf—Basher soils. These are nearly level soils on smooth or slightly concave flood plains. Slopes are 0 to 3 percent. The surface layer is silt loam, loam, or fine sandy loam. Runoff is slow, and the hazard of erosion is none to slight.

Included with these soils in mapping are a few small remnants of old stream channels where water collects after flooding and heavy rainfall.

These soils are medium in natural fertility and moderate in content of organic matter. The seasonal high water table and the flood hazard delay tillage during spring and wet periods. Artificial drainage is needed to remove excess water and improve use and management. Flooding is the main limitation to most uses. A history of flooding frequency is needed to determine the severity of the flood hazard.

These soils are suited to most shallow rooted crops commonly grown in the county. Most areas are in woodland. A few small areas have been cleared and are used for hay, pasture, or cultivated crops. Most limitations for nonfarm use are related to flooding and the seasonal high water table. Capability subclass IIw.

Bath Series

The Bath series consists of deep, well drained, gently sloping to very steep soils. These soils are on convex uplands of the broad rolling mountaintops and intermountain basins. They formed in thick glacial till material weathered from sandstone, shale, and conglomerate.

The top 2 inches in a representative profile is an organic layer of partly decomposed and undecomposed leaf litter. The surface layer is about 2 inches of very dark gray channery silt loam. The subsurface layer is about 1 inch of light brownish gray channery very fine sandy loam. The subsoil extends to a depth of 60 inches or more. The upper 26 inches is yellowish brown and dark brown light silt loam, channery silt loam, and channery loam. The lower 31 inches is firm and brittle, dark brown very channery loam.

The fragipan in these soils restricts downward movement of roots. Permeability is slow, and available water capacity is moderate to low.

Representative profile of Bath channery silt loam, in a wooded area of Bath very stony silt loam, 8 to 25 percent slopes, in Dallas Township about 1¼ miles west of Kunkle:

O1—2 inches to 1 inch; undecomposed hardwood leaf litter.

O2—1 inch to 0; partly decomposed dark colored leaf litter.

A1—0 to 2 inches; very dark gray (10YR 3/1) channery silt loam; weak very fine granular structure; friable, nonsticky, nonplastic; many small and medium roots; 30 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—2 to 3 inches; light brownish gray (10YR 6/2) channery very fine sandy loam; weak very thin platy structure; very friable, slightly sticky, nonplastic; many medium and large roots; 30 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21—3 to 14 inches; yellowish brown (10YR 5/6) light silt loam; weak fine subangular blocky structure; very friable, nonsticky, nonplastic; common small roots; 10 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22—14 to 23 inches; yellowish brown (10YR 5/6) channery silt loam; weak fine angular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 20 percent coarse fragments; very strongly acid; clear wavy boundary.

B23—23 to 29 inches; dark brown (10YR 4/3) channery loam; weak fine angular blocky structure; friable, slightly sticky, slightly plastic; few small roots; 40 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx—29 to 60 inches; dark brown (10YR 4/3) very channery loam; moderate very coarse prismatic structure parting to weak fine angular blocky; firm, brittle, slightly plastic; 60 percent coarse fragments; very strongly acid.

Solum thickness ranges from 48 to 80 inches. Depth to the Bx horizon ranges from 26 to 40 inches. Depth to bedrock is 6 feet or more. The content of coarse fragments ranges from 10 to 40 percent above the Bx horizon and from 20 to 65 percent in the Bx and C horizons. In unlimed areas reaction ranges from very strongly acid to medium acid above the Bx horizon and from very strongly acid to slightly acid in the Bx horizon. The B2 horizon ranges from brown (7.5YR 4/4 or 10YR 4/3) to light olive brown (2.5Y 5/6). The fine earth texture is loam or silt loam. The Bx horizon ranges from brown (7.5YR 4/4 or 10YR 4/3) to light olive brown (2.5Y 5/6). Prism faces, if present, range from grayish brown (2.5Y 5/2) to pale brown (10YR 6/3). Mottles with a chroma of 2 to 8 are included. The fine earth texture of the Bx horizon ranges from loam to sandy loam.

Bath, Lordstown, Mardin, and Volusia soils formed in similar material. Bath soils are deep and well drained, Lordstown soils are moderately deep and well drained. Mardin soils are deep and moderately well drained, and Volusia soils are deep and somewhat poorly drained.

BkB—Bath channery silt loam, 3 to 8 percent slopes. This gently sloping soil is in broad, smooth, slightly convex areas above the lower lying areas that have impeded drainage. Runoff is slow to medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but stones have been removed from the surface. Included in mapping are a few small areas of deep, well drained soil without a fragipan.

This Bath soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of timber and large stones and are either cultivated or used for permanent pasture. A few small areas left idle are reverting to trees. Most limitations for nonfarm use are related to the slow permeability and the content of coarse fragments. Capability subclass IIe.

BkC—Bath channery silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, slightly convex areas at the crest of hills and knolls above the lower lying, more poorly drained areas. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but this soil has no stones on the surface. Included in mapping are a few small areas of Bath very stony silt loam and a few small wet areas. Also included are a few small areas of a deep, well drained soil without a fragipan.

This Bath soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of timber and large stones and are either cultivated or used for permanent hay or pasture. Some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope, the slow permeability, and the content of coarse fragments. Capability subclass IIIe.

BkD—Bath channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on the smooth, slightly convex sides of hills and valleys. Some areas are long and narrow. Others are irregularly shaped. Runoff is medium to rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but this soil has no stone fragments on the surface. Included in mapping are a few small areas of Bath very stony silt loam and a few small areas of deep, well drained soil without a fragipan.

This Bath soil is medium in natural fertility and low in content of organic matter. Erosion is a severe hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of timber and large stones and are in permanent hay or pasture. A few areas are used occasionally for cultivated crops. Some areas are left idle and are reverting to brush and trees. Most limitations for nonfarm use are related to slope, the slow permeability, and the content of coarse fragments. Capability subclass IVe.

BnB—Bath very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is in broad, smooth, slightly convex areas above the lower lying areas that have impeded drainage. Loose stones cover about 3 to 10 percent of the surface. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but the fragipan is 2 to 4 inches deeper. Included in mapping are a few small areas of Bath channery silt loam, a few small wet areas, and a few small areas of a deep, well drained soil without a fragipan.

This Bath soil is medium in natural fertility and moderate in content of organic matter. Because of surface stones, it is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the slow permeability in the subsoil and the surface stoniness. Capability subclass VIs.

BnD—Bath very stony silt loam, 8 to 25 percent slopes. This sloping to moderately steep soil is in smooth, slightly convex areas at the crest of hills and knolls and on the long and narrow or irregularly

shaped sides of hills and valleys. Loose stones cover about 3 to 10 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small wet areas, a few small areas of Bath channery silt loam, and a few small areas of a deep, well drained soil without a fragipan.

This Bath soil is medium in natural fertility and moderate in content of organic matter. Because of surface stones, it is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to slope, the slow permeability, and the surface stoniness. Capability subclass VIs.

Braceville Series

The Braceville series consists of deep, moderately well drained, nearly level to sloping soils. These soils are on smooth, slightly concave glacial outwash terraces. They formed in thick sediments from the melting glacial ice mass.

In a representative profile, the surface layer is very dark grayish brown gravelly loam about 3 inches thick. The upper 27 inches of the subsoil is dark brown and brown gravelly loam, silt loam, gravelly silt loam, cobbly silt loam, and cobbly fine sandy loam. The lower 25 inches is firm, brittle, dark brown cobbly and gravelly loam. The substratum to a depth of 60 inches is very friable, dark brown stratified sand and gravel.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow in the fragipan. Available water capacity is moderate.

Representative profile of Braceville gravelly loam, 0 to 3 percent slopes, in Huntington Township about 1¼ miles northwest of the village of Register near the confluence of Branch and Pine Creeks:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) gravelly loam; moderate very fine granular structure; very friable, nonsticky, nonplastic; many small roots; 15 percent gravel; very strongly acid; abrupt smooth boundary.

B21h—3 to 4 inches; dark brown (7.5YR 4/4) gravelly loam; weak fine granular structure; friable, nonsticky, nonplastic; many small roots; 15 percent gravel; very strongly acid; clear wavy boundary.

B22ir—4 to 6 inches; dark brown (7.5YR 4/4) silt loam; weak very fine subangular blocky and granular structure; friable, nonsticky, nonplastic; many small roots; 10 percent gravel; very strongly acid; clear wavy boundary.

B23—6 to 22 inches; brown (10YR 4/3) gravelly silt loam; weak fine subangular blocky structure; friable, nonsticky, nonplastic; common small roots; 15 percent gravel; very strongly acid; gradual wavy boundary.

B24—22 to 27 inches; brown (10YR 4/3) cobbly silt loam; common fine faint light brownish gray (10YR 6/2) and yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; few small roots; 20 percent cobbles and gravel; very strongly acid; clear wavy boundary.

B25—27 to 30 inches; brown (10YR 5/3) cobbly fine sandy loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; firm, nonsticky, nonplastic; few fine roots; 20 percent cobbles and gravel; very strongly acid; clear wavy boundary.

Bx1—30 to 43 inches; dark brown (10YR 4/3) cobbly loam, pinkish gray (7.5YR 6/2) prism faces; common medium faint yellowish brown (10YR 5/8) mottles; weak very coarse prismatic structure parting to weak very platy; firm, brittle, slightly sticky, slightly plastic; many coarse black (N 2/0) coatings on ped faces; 20 percent cobbles and gravel; thin discontinuous clay films on prism faces; strongly acid; gradual wavy boundary.

Bx2—43 to 55 inches; dark brown (10YR 4/3) gravelly loam, brown (7.5YR 5/2) prism faces; common medium distinct yellowish red (5YR 5/8) mottles; weak very coarse prismatic structure parting to weak medium platy; firm, brittle, slightly sticky, slightly plastic; few fine black (N 2/0) coatings on ped faces; 25 percent gravel; thin patches of clay films around pores and on stone faces; strongly acid; clear wavy boundary.

IIC—55 to 60 inches; dark brown (10YR 4/3) stratified sand and gravel; common medium lenses of light yellowish brown (10YR 6/4) and bleached white (N 8/0) sand; single grained; very friable, nonsticky, nonplastic; 60 percent gravel; strongly acid.

Solum thickness ranges from 30 to 55 inches. Depth to bedrock is 5 feet or more. Depth to the Bx horizon ranges from 18 to 30 inches. The content of coarse fragments ranges from 10 to 30 percent above the Bx horizon. In unlimed areas reaction ranges from very strongly acid to medium acid above the Bx horizon and from strongly acid to slightly acid in the Bx and C horizons. The fine earth texture in the solum ranges from silt loam to sandy loam. Texture in the C horizon ranges from loam to sandy loam or stratified sand and gravel. Color in the B2 and Bx horizons ranges from dark brown (10YR 4/3 or 7.5 YR 4/4) to light olive brown (2.5Y 5/6). Color in the C horizon ranges in hue from 5YR to 2.5Y.

Braceville, Chenango, Rexford, and Wyoming soils and the Atherton variant formed in similar material. Braceville soils are moderately well drained, Chenango soils are well drained, Rexford soils are somewhat poorly drained and poorly drained, Wyoming soils are somewhat excessively drained, and the Atherton variant is poorly drained and very poorly drained. Braceville soils have a fragipan, and the Atherton variant and Chenango and Wyoming soils do not.

BrA—Braceville gravelly loam, 0 to 3 percent slopes. This nearly level soil is in smooth, slightly concave positions on glacial outwash terraces above more poorly drained soils and below better drained soils. Runoff is slow, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Braceville soils that are less than 15 percent gravel in the surface layer. Also included are a few small areas of a moderately well drained soil without a fragipan.

This Braceville soil is medium to low in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Artificial drainage is needed to remove excess water and improve use and management. Diversion terraces are needed to divert runoff from some adjacent areas. Incorporating crop residue into the soil and applying adequate lime and fertilizer help to maintain crop yields.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops, permanent hay, or pasture. A few small areas left idle are reverting to brush and trees. A few areas are in woodland. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability in the subsoil. Capability subclass IIw.

BrB—Braceville gravelly loam, 3 to 8 percent slopes. This gently sloping soil is in smooth, slightly concave positions on glacial outwash terraces. Runoff is slow to medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but depth to mottling is about 20 inches. Included in mapping are a few small areas of Braceville soil where the surface layer is less than 15 percent gravel. Also included are a few small areas of a moderately well drained soil that does not have a fragipan.

This Braceville soil is medium to low in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Artificial drainage is needed to remove excess water and improve use and management. Diversion terraces are needed to divert runoff from some adjacent areas. Contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops, hay, or permanent pasture. A few small areas left idle are reverting to brush and trees. A few areas are in woodland. Most limitations for nonfarm use are related to the seasonal high water table and the moderately slow permeability in the subsoil. Capability subclass IIw.

BrC—Braceville gravelly loam, 8 to 15 percent slopes. This sloping soil is in smooth, slightly concave positions on glacial outwash terraces above more poorly drained soils and below better drained soils. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but depth to the fragipan is about 22 inches and depth to mottling is about 18 inches. Included in mapping are a few small areas of Braceville soil where the surface layer is less than 15 percent gravel.

This Braceville soil is medium to low in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion. The seasonal high water table delays tillage early in spring and during wet periods. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops, hay, or pasture. A few small areas left idle are reverting to brush and trees. A few areas are in woodland. Most limitations for nonfarm use are related to the seasonal high water table, the moderately slow permeability in the subsoil, and slope. Capability subclass IIIe.

Buchanan Series

The Buchanan series consists of deep, moderately well drained, gently sloping to moderately steep soils. These soils are on broad, rolling mountaintops and foot slopes of mountains. They formed in thick, glacially influenced material derived from sandstone, conglomerate, and shale.

The top 2 inches in a representative profile is an organic layer of leaf litter. The surface layer is 4 inches of very dark gray channery loam. The subsoil extends to a depth of 60 inches and is 9 inches of dark reddish gray and light yellowish brown loam in the upper part. The next 7 inches is light yellowish brown gravelly loam, the lower 40 inches is dark brown, firm, very firm, and brittle gravelly and very gravelly loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate to low.

Representative profile of Buchanan channery loam, in an area of Buchanan extremely stony loam, 3 to 8 percent slopes, in Butler Township about a half mile southwest of the village of Upper Lehigh:

O1—2 inches to 1 inch; recently deposited leaf litter.

O2—1 inch to 0; dark colored partly decomposed organic leaf litter.

A1—0 to 4 inches; very dark gray (10YR 3/1) channery loam; weak fine granular structure; very friable; many small roots; 15 percent coarse fragments; extremely acid; abrupt wavy boundary.

B21h—4 to 7 inches; dark reddish gray (5YR 4/2) channery loam; weak fine and medium subangular blocky structure; friable, slightly sticky, nonplastic; many small and medium roots; 15 percent coarse fragments; extremely acid; abrupt wavy boundary.

B22t—7 to 13 inches; light yellowish brown (10YR 6/4) loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common medium roots; 6 percent coarse fragments; thin patchy clay films on ped faces; very strongly acid; gradual wavy boundary.

B23t—13 to 20 inches; light yellowish brown (10YR 6/4) gravelly loam; weak fine and medium subangular blocky structure; friable, sticky, plastic; common medium roots; 20 percent coarse fragments; thin patchy silt and clay films on ped faces; very strongly acid; gradual wavy boundary.

Bx1—20 to 30 inches; dark brown (10YR 4/3) gravelly loam, light gray (10YR 7/2) prism faces; many fine prominent yellowish red (5Y 4/6) mottles; weak very coarse prismatic structure parting to weak thick platy; firm, brittle, sticky, slightly plastic; few small roots along prism faces; 25 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx2—30 to 60 inches; dark brown (10YR 4/3) very gravelly loam, light gray (10YR 7/2) prism face and a yellowish red (5YR 4/6) rind between prism face and prism interior; moderate very coarse prismatic structure parting to weak fine blocky; very firm, brittle, slightly sticky, nonplastic; few small roots; 55 percent coarse fragments; thin silt patches on ped faces; very strongly acid.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock is 5 feet or more. Depth to the Bx horizon ranges

from 20 to 30 inches. The content of coarse fragments ranges from 5 to 40 percent in the horizons above the Bx horizon and from 20 to 60 percent in the Bx horizon. Reaction ranges from extremely acid to strongly acid throughout the profile. Color in the Bt horizon ranges from pale brown (10YR 6/3) to strong brown (7.5YR 5/6). The fine earth texture of the B21 and B2t horizons is silt loam, loam, clay loam, or sandy clay loam. Color in the Bx horizon ranges from brownish yellow (10YR 6/6) to reddish brown (5YR 4/3). Prism faces are gray, and gray or brown mottles are within the prisms. The fine earth texture in the Bx horizon is loam, clay loam, or sandy clay loam.

Buchanan, Shelmadine, Alvira, and Pocono soils formed in similar material. Buchanan soils are moderately well drained, Shelmadine soils are poorly drained, Alvira soils are somewhat poorly drained, and Pocono soils are well drained.

BuB—Buchanan channery loam, 3 to 8 percent slopes. This gently sloping soil is in smooth, slightly concave areas on broad, rolling mountaintops and foot slopes of mountains. Runoff is slow, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but this soil has no large stones and boulders on the surface. Included in mapping are a few small areas of Buchanan extremely stony loam and a few small areas of a soil that has a subsoil of sandy loam.

This Buchanan soil is low in natural fertility and moderate to low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in established or recently developed communities. Some areas are in woodland. Some areas near established communities are left idle. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability. Capability subclass IIw.

BxB—Buchanan extremely stony loam, 3 to 8 percent slopes. This gently sloping soil is in smooth, slightly concave areas on broad, rolling mountaintops and foot slopes of mountains. Loose stones cover about 15 to 25 percent of the surface. Runoff is slow, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Buchanan channery loam and a few small areas of a soil that has a subsoil of sandy loam.

This Buchanan soil is low in natural fertility and moderate to low in content of organic matter. Because of the extremely stony surface layer, this soil is not suited to cultivated crops or improved permanent pasture. It is better suited to woodland or wildlife habitat. The extremely stony surface layer restricts the use of some woodland equipment.

Most areas of this soil are in woodland. A few small areas that have been burned are reverting to brushland. Most limitations for nonfarm use are related to the extremely stony surface layer, the seasonal high water table, and the slow permeability. Capability subclass VIIs.

BxD—Buchanan extremely stony loam, 8 to 25 percent slopes. This sloping and moderately steep soil is in smooth, slightly concave areas on broad, rolling mountaintops and foot slopes of mountains. Loose stones cover about 15 to 25 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series. Included in mapping are a few small areas of Buchanan channery loam and a few small areas of a soil that has a subsoil of sandy loam.

This Buchanan soil is low in natural fertility and moderate to low in content of organic matter. Because of the extremely stony surface layer, this soil is not suited to cultivated crops or improved permanent pasture. It is better suited to woodland or wildlife habitat. The extremely stony surface layer restricts the use of some woodland equipment.

Most areas of this soil are in woodland. A few small areas that have been burned are reverting to brushland. Most limitations for nonfarm use are related to the extremely stony surface layer, the seasonal high water table, the slow permeability, and slope. Capability subclass VIIs.

Chenango Series

The Chenango series consists of deep, well drained, nearly level to sloping soils. These soils are on terraces, kames, and moraines. They formed in thick glacial outwash sediments from the melting glacial ice mass.

The top inch in a representative profile is an organic layer of undecomposed leaf litter. The surface layer is 5 inches of very dark grayish brown gravelly loam. The subsoil is brown gravelly silt loam and gravelly heavy loam about 19 inches thick. The substratum to a depth of 60 inches is brown and reddish brown very gravelly loamy sand and very gravelly coarse sand.

Permeability is moderately rapid to rapid in the subsoil and substratum. Available water capacity is low to very low.

Representative profile of Chenango gravelly loam, 3 to 8 percent slopes, in Fairmount Township about 1¼ miles northeast of the village of Rittenhouse near the confluence of Phillips Creek and Huntington Creek:

O1—1 inch to 0; undecomposed leaf litter.

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) gravelly loam; weak very fine granular structure; very friable, nonsticky, nonplastic; many small and medium roots; 20 percent gravel; strongly acid; gradual wavy boundary.

B21—5 to 12 inches; brown (7.5YR 5/4) gravelly silt loam; weak very fine and fine angular blocky structure; friable, slightly sticky, slightly plastic; common small and medium roots; 30 percent gravel; thin patchy clay films in pores; strongly acid; gradual wavy boundary.

B22—12 to 24 inches; brown (7.5YR 5/4) gravelly heavy loam; weak very fine and fine angular blocky structure; friable, slightly sticky, slightly plastic; common

small and medium roots; 40 percent gravel and cobbles; thin patchy clay films around pores; medium acid; clear wavy boundary.

IIC1—24 to 36 inches; brown (7.5YR 5/4) very gravelly loamy sand; single grained; loose, nonsticky, nonplastic; common small roots; 65 percent gravel and cobbles; strongly acid; gradual wavy boundary.

IIC2—36 to 60 inches; reddish brown (5YR 5/3) very gravelly coarse sand; single grained; loose, nonsticky, nonplastic; few small roots; 65 percent rounded gravel and cobbles; strongly acid.

Solum thickness ranges from 24 to 30 inches. Depth to bedrock is 6 feet or more. The content of coarse fragments ranges from 20 to 50 percent in the B horizon and from 60 to 70 percent in the C horizon. Coarse fragments are mainly gravel; some are cobblestones and channery fragments. In unlimed areas reaction in the B2 horizon ranges from very strongly acid to medium acid. The B2 horizon has a hue of 7.5YR to 2.5Y, a value of 4 or 5, and a chroma of 3 to 6. Texture in the fine earth fraction of the B2 horizon ranges from fine sandy loam to silt loam, and sand typically increases with increasing depth. The C horizon is dominantly sand and gravel.

Chenango, Braceville, Rexford, and Wyoming soils and the Atherton variant formed in similar material. Chenango soils are well drained, Braceville soils are moderately well drained, Rexford soils are somewhat poorly drained, Wyoming soils are somewhat excessively drained, and the Atherton variant is poorly drained and very poorly drained.

ChA—Chenango gravelly loam, 0 to 3 percent slopes. This nearly level soil is in broad, smooth, slightly convex positions on glacial outwash terraces. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but depth to sand and gravel layers is about 28 inches. Included in mapping are a few small areas, near Harding, where the subsoil to a depth of 40 inches or more is less than 35 percent gravel. Also included are a few small wet areas and, near Nanticoke and Nescopeck Boro, a few small areas of soils that are dominantly very fine sandy loam and have few pebbles or coarse fragments to a depth of 40 inches.

This Chenango soil is low in natural fertility and low in content of organic matter. It is easily tilled during most of the year. Because of the moderately rapid to rapid permeability in the subsoil and substratum, nutrients from fertilizer leach through the soil rapidly. The hazard of erosion is slight.

This soil is suited to most drought-tolerant crops commonly grown in the county. Most areas are in crops or hay. Some areas are in permanent pasture, and some have been quarried for sand and gravel. Several areas along the Susquehanna River are in urban use. Most limitations for nonfarm use are related to the moderately rapid to rapid permeability and the possibility of ground water contamination. Capability subclass IIs.

ChB—Chenango gravelly loam, 3 to 8 percent slopes. This gently sloping soil is in broad, smooth to slightly undulating, convex positions on glacial outwash terraces. Runoff is slow, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping are a few areas, near Harding, where the subsoil to a depth of 40 inches or more is less than 35 percent gravel. Also included, near Nanticoke and Nescopeck Boro, are a few small areas of soils that are dominantly very fine sandy loam and have few pebbles or coarse fragments to a depth of 40 inches.

This Chenango soil is low in natural fertility and low in content of organic matter. It is easily tilled during most of the year. Because of the moderately rapid to rapid permeability in the subsoil and substratum, nutrients from fertilizer leach through this soil rapidly. The hazard of erosion is moderate. Diversion terraces and contour stripcropping are needed to control erosion.

This soil is suited to most drought-tolerant crops commonly grown in the county. Most areas are in cultivated crops or hay. Some areas are in permanent pasture, and some have been quarried for sand and gravel. Several areas along the Susquehanna River are in urban use. Most limitations for nonfarm use are related to the moderately rapid to rapid permeability, the possibility of ground water contamination, and the content of coarse fragments. Capability subclass IIs.

ChC—Chenango gravelly loam, 8 to 15 percent slopes. This sloping soil is in smooth or rolling, convex positions on glacial outwash terraces, moraines, kames, and eskers. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but this soil has slightly more gravel fragments on the surface. Included in mapping are a few small areas, near Harding, where the subsoil to a depth of 40 inches is less than 35 percent gravel. Also included are a few small areas where the depth to sand and gravel is about 18 inches.

This Chenango soil is low in natural fertility and low in content of organic matter. This soil is easily tilled during most of the year. Because of the moderately rapid to rapid permeability in the subsoil and substratum, nutrients from fertilizer leach through this soil rapidly. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes grasses and legumes are needed to control erosion.

This soil is suited to most drought-tolerant crops commonly grown in the county. Most areas are in hay or permanent pasture, and a few areas are in crops or woodland. A few areas are used for building sites, and some have been quarried for sand and gravel. Most limitations for nonfarm use are related to the moderately rapid to rapid permeability, the possibility of ground water contamination, the content of coarse fragments, and slope. Capability subclass IIIe.

Chippewa Series

The Chippewa series consists of deep, poorly drained and very poorly drained, nearly level and gently sloping soils. These soils are on broad, rolling mountaintops and in intermountain basins in low lying depressions and upland drainageways. They formed in thick glacial till material derived from conglomerate, sandstone, and shale.

In a representative profile, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is 2 inches of mottled grayish brown silt loam. The upper 11 inches of the subsoil is mottled gray channery silt loam, and the lower 25 inches is firm and brittle, mottled grayish brown and yellowish brown channery loam and channery silt loam. The substratum to a depth of 60 inches is mottled gray very channery silt loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is very slow in the fragipan. Available water capacity is moderate. The high water table is at a depth of 0 to 6 inches during wet periods.

Representative profile of Chippewa silt loam, in an area of Chippewa very stony silt loam, 0 to 8 percent slopes, in Huntington Township about 1½ miles east of Cambra:

A1—0 to 7 inches; very dark gray (10YR 3/1) silt loam; many fine prominent strong brown (7.5YR 5/6) and dark reddish brown (5YR 3/4) mottles; weak medium granular structure; very friable, slightly plastic; many small roots; 10 percent coarse fragments; strongly acid; clear wavy boundary.

A2g—7 to 9 inches; grayish brown (2.5Y 5/2) silt loam; many fine prominent yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common roots; 10 percent coarse fragments; thick continuous silt films around pores; strongly acid; gradual wavy boundary.

B21g—9 to 15 inches; gray (5Y 5/1) channery silt loam; many coarse prominent yellowish brown (10YR 5/8) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky, slightly plastic; common roots; 15 percent coarse fragments; thin discontinuous clay films in pores; strongly acid; gradual wavy boundary.

B22g—15 to 20 inches; gray (5Y 5/1) channery silt loam; many coarse prominent yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; friable, slightly firm, slightly sticky, slightly plastic; 15 percent coarse fragments; strongly acid; clear wavy boundary.

Bx1—20 to 34 inches; grayish brown (10YR 5/2) channery loam, gray (5Y 5/1) prism faces; many coarse distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4 and 5/8) mottles; moderate very coarse prismatic structure parting to weak fine and medium subangular blocky; firm, brittle, slightly sticky, nonplastic; 30 percent coarse fragments; thick continuous silt films on ped faces; medium acid; clear wavy boundary.

Bx2—34 to 45 inches; yellowish brown (10YR 5/4) channery silt loam; gray (5Y 5/1) mottles; moderate very coarse prismatic structure parting to weak coarse subangular blocky; firm, brittle, sticky, plastic; 20 percent coarse fragments; medium acid; clear wavy boundary.

Cg—45 to 60 inches; gray (N 5/0) very channery silt loam many medium distinct yellowish brown (10YR 5/6 and 5/4) mottles; massive; friable, slightly sticky, slightly plastic; 50 percent coarse fragments; neutral.

Solum thickness ranges from 40 to 55 inches. Depth to the Bx horizon ranges from 15 to 20 inches. Depth to bedrock is 5 feet or more. The content of coarse fragments ranges from 5 to 30 percent above the Bx horizon and from 20 to 50 percent in the Bx and C horizons. Reaction ranges from very strongly acid to strongly acid above the Bx horizon, from strongly acid to slightly acid in the Bx horizon, and from medium acid to neutral in the C horizon. Color in the B2g and Bx horizons ranges from dark gray (10YR 4/1) to olive gray (5Y 5/2). Below 30 inches the Bx horizon has a chroma of 3 or 4. Color in the C horizon is similar to that in the Bx horizon.

Chippewa, Morris, Volusia, Mardin, and Wellsboro soils formed in similar material. Chippewa soils are poorly drained and very poorly drained, Morris and Volusia soils are somewhat poorly drained, and Mardin and Wellsboro soils are moderately well drained.

ClA—Chippewa silt loam, 0 to 3 percent slopes. This nearly level soil is in low lying, concave positions in upland depressions and drainageways. It receives much runoff from adjacent areas. Runoff is very slow, ponding is common, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but this soil has no stones on the surface. Included in mapping are a few small areas of Chippewa very stony silt loam. Also included are a few small areas of a poorly drained and very poorly drained soil that has a clayey subsoil and no fragipan.

This Chippewa soil is medium in natural fertility and moderate to high in content of organic matter. Because of the high water table, tillage is delayed in spring or during wet periods. If this soil is used for cultivated crops, artificial drainage is needed to remove excess water and improve use and management. Diversion terraces are needed to divert runoff from some surrounding areas.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in permanent pasture or have been left idle and are reverting to woodland. A few small areas are used for cultivated crops. Most limitations for nonfarm use are related to the high water table, the very slow permeability in the subsoil, and the possibility of ponding. Capability subclass IVw.

ClB—Chippewa silt loam, 3 to 8 percent slopes. This gently sloping soil is in low lying, concave positions in upland depressions and drainageways. It receives much runoff from adjacent areas. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but this soil has no stones on the surface. Included in mapping are a few small areas of Chippewa very stony silt loam.

This Chippewa soil is medium in natural fertility and moderate to high in content of organic matter. Because of the high water table, tillage is delayed in spring or during wet periods. If this soil is used for cultivated crops, artificial drainage is needed to improve use and management. Diversion terraces are needed to divert runoff from some surrounding areas.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in permanent pasture or have been idle and are reverting to woodland. A few small areas are used for cultivated crops. Most limitations for nonfarm use are related to the high water table and the very slow permeability in the subsoil. Capability subclass IVw.

CnB—Chippewa very stony silt loam, 0 to 8 percent slopes. This nearly level and gently sloping soil is in low lying, concave positions in upland depressions and

drainageways. It receives much runoff from adjacent areas. Loose stones cover about 1 to 10 percent of the surface. Runoff is slow or very slow, ponding is common, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Chippewa silt loam and a few small areas of Chippewa soils where more than 10 percent of the surface is covered with stones.

This Chippewa soil is medium in natural fertility and moderate to high in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. If this soil is used for permanent pasture, artificial drainage may be needed to improve use and mangement. The high water table restricts the use of woodland equipment during wet periods.

Most areas of this soil are in woodland or wetland shrubs. Most limitations for nonfarm use are related to the high water table, the very slow permeability, and the surface stoniness. Capability subclass VIIs.

Dekalb Series

The Dekalb series consists of moderately deep, well drained, nearly level to very steep soils. These soils are on mountain ridges and the convex tops and sides of hills and knolls of broad, rolling mountaintops and intermountain basins. They formed in moderately thick glacial till material derived from sandstone, conglomerate, and some shale.

The top inch in a representative profile is an organic layer of burned leaf litter. The surface layer is 2 inches of very dark gray channery sandy loam. The subsurface layer is about 4 inches of light yellowish brown channery sandy loam. The subsoil is yellowish brown channery sandy loam about 15 inches thick. The underlying material is brown very channery sandy loam about 7 inches thick. Brown sandstone bedrock is at a depth of 28 inches.

Permeability is moderately rapid, and available water capacity is moderate to very low.

Representative profile of Dekalb channery sandy loam, in a burned area of Dekalb extremely stony sandy loam, 8 to 25 percent slopes, in Dennison Township about 2 miles southeast of Mountain Top:

O2—1 inch to 0; black burned grass, shrub, and leaf litter.
A1—0 to 2 inches; very dark gray (10YR 3/1) channery sandy loam; weak very fine granular structure; very friable, nonsticky, nonplastic; many small roots; 20 percent coarse fragments; very strongly acid; abrupt wavy boundary.
A2—2 to 6 inches; light yellowish brown (10YR 6/4) channery sandy loam; weak fine granular structure; very friable, nonsticky, nonplastic; many small roots; 20 percent coarse fragments; very strongly acid; gradual wavy boundary.
B2—6 to 16 inches; yellowish brown (10YR 5/4) channery sandy loam; weak fine and medium subangular blocky structure; friable, nonsticky, nonplastic; few small roots; 30 percent coarse fragments; few thin patchy clay films; very strongly acid; gradual wavy boundary.
B3—16 to 21 inches; yellowish brown (10YR 5/4) channery sandy loam; weak medium subangular blocky structure; friable, nonsticky, nonplastic; few small roots; 35 percent coarse fragments; very strongly acid; gradual wavy boundary.
C—21 to 28 inches; brown (7.5YR 5/4) very channery sandy loam; single grained; loose, nonsticky, nonplastic; few roots; 75 percent coarse fragments; very strongly acid; abrupt wavy boundary.
R—28 inches; brown coarse grained sandstone.

Solum thickness and depth to bedrock range from 20 to 40 inches. The content of coarse fragments ranges from 15 to 60 percent in individual horizons within the solum and from 50 to 90 percent or more in the C horizon. Reaction throughout the profile ranges from extremely acid to strongly acid. The fine earth texture in the solum is loam or sandy loam, and the fine earth texture in the C horizon is sandy loam or loamy sand. A thin, dark brown (10YR 3/3, 4/3) Bir horizon is common in pedons in wooded areas. Color in the B horizon ranges from yellowish brown (10YR 5/4) to reddish yellow (7.5YR 6/8). Color in the C horizon ranges from brown (7.5YR 5/4) to yellowish brown (10YR 5/6).

Dekalb, Pocono, Lordstown, Oquaga, and Arnot soils formed in similar material. Dekalb, Lordstown, and Oquaga soils are moderately deep and well drained; Pocono soils are deep and well drained; and Arnot soils are shallow and well drained. Dekalb soils have more sand throughout the profile than Lordstown and Oquaga soils, which are dominantly silt loam or loam. Dekalb soils are less red throughout the profile than Oquaga soils.

DdB—Dekalb extremely stony sandy loam, 0 to 8 percent slopes. This nearly level and gently sloping soil is on convex mountain ridgetops; hills and knolls; and broad, smooth uplands. Loose stones and boulders cover about 15 to 25 percent of the surface. In places rock outcrop covers 2 to 5 percent. Runoff is medium, and the hazard of erosion is slight.

Included with this soil in mapping, near Hazleton, are a few small areas of a moderately deep, well drained soil that has a surface layer of loamy sand. Also included are a few small areas of a soil that is less than 20 inches deep over bedrock and a few small areas of a soil that is more than 40 inches deep over bedrock.

This Dekalb soil is low in natural fertility and low in content of organic matter. Because of the extremely stony surface layer, this soil is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, and esthetic uses. The extremely stony surface layer restricts the use of some woodland equipment.

Most areas of this soil are in woodland. Most limitations for nonfarm use are related to the depth to bedrock and the surface stoniness. Capability subclass VIIs.

DdD—Dekalb extremely stony sandy loam, 8 to 25 percent slopes. This sloping and moderately steep soil is on convex mountain ridgetops and the sides of hills, knolls, and mountain ridges. Loose stones and boulders are about 15 to 25 percent of the surface. In places rock outcrop covers 2 to 5 percent. Runoff is medium to rapid, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping, near Hazleton, are a few small areas of a moderately deep, well drained soil that has a surface layer of loamy sand. Also included are a few small areas of a soil that is less than 20 inches deep over bedrock and a few small areas of

a soil that is more than 40 inches deep over bedrock.

This Dekalb soil is low in natural fertility and low in content of organic matter. Because of the extremely stony surface layer, this soil is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, and esthetic uses. The extremely stony surface layer restricts the use of some woodland equipment.

Most areas of this soil are in woodland. Most limitations for nonfarm use are related to the depth to bedrock, slope, and the surface stoniness. Capability subclass VIIs.

DEF—Dekalb extremely stony sandy loam, steep. This steep and very steep soil is on the convex sides of mountain ridges and hills. The surface area is about 15 to 35 percent loose stones and boulders. In places the surface area is about 15 to 35 percent loose stones and boulders. In places the surface area is about 3 to 7 percent rock outcrop. Runoff is rapid, and the hazard of erosion is slight.

Because of the steep and very steep slopes, this soil has not been investigated as thoroughly as the less sloping Dekalb soils, and it contains more inclusions than those soils.

This Dekalb soil is low in natural fertility and low in content of organic matter. Because of the steep slopes, this soil is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, and esthetic uses. The steep and very steep slopes restrict the use of some woodland equipment.

Most areas of this soil are in woodland. Most limitations for nonfarm use are related to the depth to bedrock and slope. Capability subclass VIIs.

Holly Series

The Holly series consists of deep, poorly drained, nearly level soils on flood plains. These soils formed in mixed alluvial material deposited by streams.

The top inch in a representative profile is an organic layer of partly decomposed leaf litter. The surface layer is 5 inches of dark gray silt loam. The subsoil is light brownish gray silt loam about 23 inches thick. The substratum to a depth of 60 inches is 10 inches of light gray very fine sandy loam and silty clay loam and 22 inches of gray and dark gray silt loam.

Permeability is moderate to moderately slow, and available water capacity is high. These soils are subject to frequent flooding. The seasonal high water table is within a depth of 6 inches during wet periods and after stream overflow.

Representative profile of Holly silt loam, in a wooded area in Lehman Township about a half mile west of Lake Silkworth:

O2—1 inch to 0; partly decomposed organic leaf layer.

A1—0 to 5 inches; dark gray (10YR 4/1) silt loam; weak medium granular structure; very friable, nonsticky, slightly plastic; many small roots; medium acid; abrupt wavy boundary.

B21g—5 to 12 inches; light brownish gray (10YR 6/2) silt loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; few thin patchy clay films on ped faces; medium acid; gradual wavy boundary.

B22g—12 to 28 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/8) and brown (7.5YR 5/2) mottles; weak medium prismatic structure parting to weak medium and coarse subangular blocky; friable to slightly firm, slightly sticky, slightly plastic; few small roots; less than 1 percent partly weathered coarse fragments; thin continuous clay films on prism and ped faces; neutral; clear wavy boundary.

IIC1g—28 to 34 inches; light gray (10YR 6/1) very fine sandy loam; few fine distinct yellowish brown (10YR 5/8) mottles; massive; friable, nonsticky, nonplastic; few small dead roots; less than 1 percent gravel; neutral; gradual wavy boundary.

IIC2g—34 to 38 inches; light gray (N 7/0) silty clay loam; common medium distinct light olive brown (2.5Y 5/6) mottles decreasing in quantity with depth; massive; firm, sticky, plastic; few small dead roots; few thin patchy clay films in pores; neutral; gradual wavy boundary.

IIC3g—38 to 49 inches; gray (10YR 5/1) silt loam; many coarse faint very dark grayish brown (10YR 3/2) mottles and organic stains; massive; very friable, slightly sticky, slightly plastic; few fine partly decomposed roots; neutral; gradual wavy boundary.

IIC4g—49 to 60 inches; dark gray (10YR 4/1) silt loam; massive; very friable, slightly sticky, slightly plastic; neutral.

Thickness of loamy deposits over other stratified material ranges from 40 to more than 60 inches. Reaction ranges from strongly acid to neutral; the higher reactions are in the lower part of the profile. The B horizon has a hue of 10YR, 2.5Y, or N; a value of 4 to 6; and a chroma of 2 or less. Texture is dominantly silt loam or loam, but in places it is sandy loam and silty clay loam. The C horizon is gleyed and has a chroma of less than 2. The content of coarse fragments ranges from 0 to 30 percent in the IIC horizon.

Holly, Wayland, Basher, and Linden soils formed in similar material. Holly soils are poorly drained, Wayland soils are very poorly drained, Basher soils are moderately well drained and somewhat poorly drained, and Linden soils are well drained.

Ho—Holly silt loam. This is a nearly level soil on smooth or slightly concave flood plains. Slopes are 0 to 3 percent. Runoff is slow, and the hazard of erosion is slight. This soil is subject to frequent flooding.

Included with this soil in mapping are a few small areas that have been gouged by floodwater. Also included are a few small areas where sandy and gravelly layers are within 40 inches of the surface.

This Holly soil is medium in natural fertility and moderate in content of organic matter. The seasonal high water table and the flood hazard delay tillage during wet periods. The hazard of flooding is the main limitation for most uses. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in woodland or wetland shrubs. A few areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table and the frequent flooding. Capability subclass IIIw.

Kedron Series

The Kedron series consists of deep, moderately well drained and somewhat poorly drained, nearly level to

moderately steep soils. These soils are on uplands and in depressions and drainageways of broad, rolling intermountain basins. They formed in thick old glacial till material derived from sandstone, siltstone, and shale.

In a representative profile, the surface layer is dark reddish brown channery silt loam about 9 inches thick. The subsoil to a depth of 60 inches is 13 inches of reddish brown channery silt loam and silty clay loam and 38 inches of firm and brittle, mottled reddish brown channery silt loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate.

Representative profile of Kedron channery silt loam, 8 to 15 percent slopes, in Sugar Loaf Township about 2½ miles west of Conyngham, north of Legislative route 40010, and west of Township route 301:

Ap—0 to 9 inches; dark reddish brown (5YR 3/3) channery silt loam; moderate medium and fine granular structure; friable, slightly sticky, slightly plastic; many roots; 20 percent coarse fragments; neutral; abrupt smooth boundary.

B1—9 to 13 inches; reddish brown (5YR 4/3) channery silt loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common roots; 15 percent coarse fragments; medium acid; gradual wavy boundary.

B2t—13 to 22 inches; reddish brown (5YR 5/3) silty clay loam; weak medium and fine subangular blocky structure; firm, slightly sticky, plastic; common roots; common thin clay films on ped faces; 10 percent coarse fragments; strongly acid; clear wavy boundary.

Bx1—22 to 38 inches; reddish brown (2.5YR 4/4) channery silt loam, light gray (10YR 6/1) prism faces; few medium distinct grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to moderate thick platy and fine angular blocky; firm, brittle, slightly sticky, plastic; few roots along prism faces; common moderately thick clay films in pores and on ped faces; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx2—38 to 60 inches; reddish brown (2.5YR 4/4) channery silt loam, grayish brown (10YR 5/2) upper prism faces; few to common medium distinct strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; weak very coarse prismatic structure parting to weak thick platy and fine angular blocky; firm, brittle, slightly sticky, plastic; few moderately thick clay films in pores and on small ped faces; few thin black coatings; 40 percent coarse fragments; very strongly acid.

Solum thickness ranges from 40 to 65 inches or more. Depth to bedrock is 5 feet or more. Depth to the Bx horizon ranges from 20 to 32 inches. The content of coarse fragments ranges from 0 to 20 percent above the Bx horizon and from 15 to 50 percent in the Bx horizon. In unlimed areas reaction ranges from extremely acid to strongly acid throughout the profile. Depth to mottles with a low chroma ranges from 12 to 30 inches. Color in the B1 and B2t horizons ranges from reddish brown (5YR 4/3) to red (2.5YR 5/6). Texture ranges from silt loam to clay loam. Color in the Bx horizon ranges from weak red (10YR 4/2) to yellowish red (5YR 5/6). Texture is loam or silt loam.

Kedron, Leck Kill, and Meckesville soils formed in similar material. Kedron soils are deep and moderately well drained and somewhat poorly drained, and Leck Kill and Meckesville soils are deep and well drained.

KdB—Kedron channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly concave uplands of broad, rolling intermountain basins. Runoff is slow to medium, and the hazard of erosion is moderate.

Included with this soil in mapping are a few small areas of Lackawanna and Wellsboro soils and a few small areas of poorly drained and very poorly drained soils. Also included are a few small areas of Kedron very stony silt loam.

This Kedron soil is medium to high in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops or hay. Some areas are used for permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and the content of coarse fragments. Capability subclass IIw.

KdC—Kedron channery silt loam, 8 to 15 percent slopes. This sloping soil is on smooth, slightly concave uplands and in drainageways of broad, rolling intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Lackawanna and Wellsboro soils and a few small areas of poorly drained and very poorly drained soils. Also included are a few small areas of Kedron very stony silt loam.

This Kedron soil is medium to high in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring or during wet periods. Erosion is a moderate hazard if the soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops or hay. Some areas are used for permanent pasture, and a few areas left idle for reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and slope. Capability subclass IIIe.

KeB—Kedron very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is on smooth, slightly concave uplands of broad, rolling intermountain basins. Loose stones cover about 1 to 5 percent of the surface. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface. Included in mapping are a few small areas of Lackawanna and Wellsboro

soils and a few small areas of poorly drained and very poorly drained soils. Also included are a few small areas of Kedron channery silt loam.

This Kedron soil is medium to high in natural fertility and moderate in content of organic matter. Because of surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability in the subsoil, and the surface stoniness. Capability subclass VIs.

KeC—Kedron very stony silt loam, 8 to 20 percent slopes. This sloping and moderately steep soil is on smooth, slightly concave uplands and in drainageways of broad, rolling intermountain basins. Loose stones cover about 1 to 5 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface. Included in mapping are a few small areas of Lackawanna and Wellsboro soils and a few small areas of poorly drained and very poorly drained soils. Also included are a few small areas of Kedron channery silt loam.

This Kedron soil is medium to high in natural fertility and moderate in content of organic matter. Because of surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, slope, and the surface stoniness. Capability subclass VIs.

KwB—Kedron channery silt loam, somewhat poorly drained, 0 to 8 percent slopes. This nearly level and gently sloping soil is in concave depressions, drainageways, and swales of broad, rolling intermountain basins. Runoff is slow, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but depth to gray mottles is 10 to 18 inches. Included in mapping are a few small areas of poorly drained and very poorly drained soils and a few areas of the somewhat poorly drained Kedron very stony silt loam.

This Kedron soil is medium to high in natural fertility and moderate in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion in steeper areas. Incorporating crop residue into the soil and applying adequate amounts of lime and fertilizer help to maintain crop yields.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for permanent hay or pasture. A few small areas are used for cultivated crops, and a few small areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and the content of coarse fragments. Capability subclass IIIw.

KxB—Kedron very stony silt loam, somewhat poorly drained, 0 to 8 percent slopes. This nearly level and gently sloping soil is in concave depressions, drainageways, and swales of broad, rolling intermountain basins. Loose stones cover about 1 to 5 percent of the surface. Runoff is slow, and the hazard of eroesion is slight.

The profile of this soil is similar to the one described as representative of the series, but depth to gray mottles is 10 to 18 inches and stones have not been removed from the surface. Included in mapping are a few small areas of poorly drained and very poorly drained soils and a few small areas of the somewhat poorly drained Kedron channery silt loam.

This Kedron soil is medium to high in natural fertility and moderate in content of organic matter. Because of surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields. Artificial drainage is needed to remove excess water and improve use and management.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and the surface stoniness. Capability subclass VIIs.

Klinesville Series

The Klinesville series consists of shallow, well drained, gently sloping to moderately steep soils. These soils are on the slightly convex tops and sides of ridges, hills, and knolls of broad, rolling intermountain basins. They formed in thin glacial till material derived from shale, siltstone, and weathered sandstone.

The top 2 inches in a representative profile is an organic layer of black, partly decomposed leaf litter. The surface layer is about 2 inches of dark reddish brown channery silt loam. The subsoil is dark reddish brown and dark red channery silt loam about 11 inches thick. The underlying material is dark reddish brown very channery silt loam about 4 inches thick. Red shale bedrock is at a depth of 17 inches.

These soils have a shallow root zone. Permeability is moderately rapid, and available water capacity is very low.

The Klinesville soils in Luzerne County are mapped only with Weikert soils.

Representative profile of Klinesville channery silt loam in an area of Weikert and Klinesville channery silt loams, 3 to 8 percent slopes, in Fairview Township at Mountain Top:

O2—2 inches to 0; black (N 2/0) partly decomposed organic leaf litter.
A1—0 to 2 inches; dark reddish brown (5YR 2/2) channery silt loam; weak very fine granular structure; friable, nonsticky, nonplastic; many small roots; 15 percent coarse fragments; very strongly acid; abrupt wavy boundary.
B1—2 to 9 inches; dark reddish brown (2.5YR 3/4) channery silt loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 20 percent coarse fragments; very strongly acid; clear wavy boundary.
B2—9 to 13 inches; dark red (2.5YR 3/6) channery silt loam; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 35 percent coarse fragments; very strongly acid; clear wavy boundary.
C—13 to 17 inches; dark reddish brown (2.5YR 3/4) very channery silt loam; weak fine to very fine subangular blocky structure; friable, slightly sticky, slightly plastic; few roots; 85 percent coarse fragments; very strongly acid; clear wavy boundary.
R—17 inches; weak red (2.5YR 4/2) shale bedrock.

Solum thickness and depth to bedrock range from 10 to 20 inches. The content of coarse fragments ranges from 15 to 50 percent in the A and B horizons and from 50 to 90 percent in the C horizon. Coarse fragments are dominantly shale, siltstone, and fine grained sandstone. In unlimed areas reaction ranges from very strongly acid to strongly acid throughout the profile. The fine earth texture is silt loam or loam throughout. Color in the B and C horizons ranges from dark reddish brown (5YR 3/3) to red (2.5YR 4/6).

Klinesville, Arnot, and Weikert soils formed in similar material. Klinesville soils have dominantly fine grained sandstone and conglomerate coarse fragments throughout the profile, and Arnot soils have dominantly coarse grained sandstone and conglomerate coarse fragments. Klinesville soils have a hue redder than 5YR, and Weikert soils have a hue yellower than 7.5YR.

Lackawanna Series

The Lackawanna series consists of deep, well drained, gently sloping to very steep soils. These soils are on the convex uplands of broad, rolling mountaintops and intermountain basins and on the lower slopes of mountain ridges. They formed in thick glacial till material derived from sandstone and shale.

In a representative profile, the surface layer is dark reddish gray channery silt loam about 6 inches thick. The subsurface layer is reddish brown channery silt loam about 4 inches thick. The subsoil to a depth of 60 inches is 7 inches of reddish brown channery loam and 43 inches of firm and brittle, reddish brown channery silt loam and channery loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate to low.

Representative profile of Lackawanna channery silt loam, 3 to 8 percent slopes, in Slocum Township about 1½ miles northwest of Slocum:

Ap—0 to 6 inches; dark reddish gray (5YR 4/2) channery silt loam; weak fine and very fine granular structure; very friable, nonsticky, nonplastic; many small roots; 15 percent coarse fragments; strongly acid; abrupt smooth boundary.
A2—6 to 10 inches; reddish brown (5YR 4/3) channery silt loam; weak thin platy structure; friable, slightly sticky, slightly plastic; common small roots; 20 percent coarse fragments; strongly acid; gradual wavy boundary.
B2—10 to 17 inches; reddish brown (5YR 4/3) channery loam; weak very fine and fine subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 20 percent coarse fragments; few thin patchy clay films around pores; very strongly acid; gradual wavy boundary.
Bx1—17 to 49 inches; reddish brown (5YR 4/3) channery silt loam, reddish brown (5YR 5/3) prism faces; weak very coarse prismatic structure parting to weak fine and medium subangular blocky, firm, brittle, slightly sticky, slightly plastic; few small roots; 50 percent coarse fragments; common coarse black (N 2/0) coatings on ped faces; thin continuous clay films in pores; very strongly acid; gradual wavy boundary.
Bx2—49 to 60 inches; reddish brown (2.5YR 4/4) channery loam, weak red (2.5YR 5/2) prism faces; weak very coarse prismatic structure parting to weak fine and medium angular blocky; firm, brittle, slightly sticky, slightly plastic; 45 percent coarse fragments; common coarse black (N 2/0) coatings on ped faces; thin continuous clay films in pores; very strongly acid.

Solum thickness ranges from 40 to 75 inches or more. Depth to bedrock is 6 feet or more. Depth to the Bx horizon ranges from 17 to 36 inches. The content of coarse fragments ranges from 15 to 40 percent in individual horizons above the Bx horizon and from 15 to 50 percent in the Bx and C horizons. The fine earth texture of the solum is dominantly loam or silt loam, but the A2 horizon ranges to fine sandy loam. In unlimed areas reaction is very strongly acid or strongly acid above the Bx horizon and very strongly acid to medium acid in the Bx and C horizons. Color in the B2 horizon ranges from reddish brown (2.5YR 4/4) to yellowish brown (10YR 5/6). Color in the Bx horizon ranges from weak red (2.5YR 4/2) to reddish brown (5YR 5/4). Prism faces range from weak red (2.5YR 5/2) to light reddish brown (5YR 6/3). The Bx horizon in some pedons has gray or brown mottles below 30 inches. Color and texture in the C horizon are similar to those in the Bx horizon.

Lackawanna, Oquaga, Wellsboro, and Morris soils formed in similar material. Lackawanna soils are deep and well drained. Oquaga soils are moderately deep and well drained. Wellsboro soils are deep and moderately well drained, and Morris soils are deep and somewhat poorly drained.

LaB—Lackawanna channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on the broad, smooth, slightly convex uplands of broad, rolling mountaintops and intermountain basins. Runoff is slow, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Lackawanna very stony silt loam, a few small wet areas, and a few small areas of deep, well drained soil that does not have a fragipan.

This Lackawanna soil is medium in natural fertility and low in content of oragnic matter. Erosion is a moderate hazard if the soil is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of timber

and large stones and are used for cultivated crops, hay, or permanent pasture. A few small areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the slow permeability and the content of coarse fragments. Capability subclass IIe.

LaC—Lackawanna channery silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, slightly convex areas at the crest of the hills and knolls of broad, rolling mountaintops and intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are a few small areas of Lackawanna very stony silt loam, and a few small wet areas, and a few small areas of a deep, well drained soil that does not have a fragipan.

This Lackawanna soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of timber and large stones and are used for cultivated crops, hay, or permanent pasture. Some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the slow permeability, slope, and the content of coarse fragments. Capability subclass IIIe.

LaD—Lackawanna channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on the smooth, slightly convex sides of the hills and valleys of broad, rolling mountaintops and intermountain basins. Some areas are long and narrow. Others are irregularly shaped. Runoff is medium to rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 4 to 6 inches thick. Included in mapping are a few small areas of Lackawanna very stony silt loam, a few small areas of bedrock outcrop, and a few small areas of a deep, well drained soil that does not have a fragipan.

This Lackawanna soil is medium in natural fertility and low in content of organic matter. Erosion is a severe hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county, but it is better suited to permanent hay or pasture. Most areas have been cleared of trees and large stones and are in permanent hay or pasture. A few areas are used occasionally for cultivated crops. Some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope, the slow permeability, and the content of coarse fragments. Capability subclass IVe.

LcB—Lackawanna very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is on the broad, smooth, slightly convex uplands of broad, rolling mountaintops and intermountain basins. The surface area is about 3 to 10 percent loose stones. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but large stones and boulders have not been cleared from the surface and the soil has no plow layer. Included in mapping are a few small areas of Lackawanna channery silt loam, a few small wet areas, and a few small areas of a deep, well drained soil that does not have fragipan.

This Lackawanna soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the slow permeability and the surface stoniness. Capability subclass VIs.

LcD—Lackawanna very stony silt loam, 8 to 25 percent slopes. This sloping and moderately steep soil is in smooth, slightly convex areas at the crest of hills and knolls and on the sides of the hills and valleys of broad, rolling mountaintops, intermountain basins, and the lower slopes of mountain ridges. Some areas are long and narrow. Others are irregularly shaped. The surface area is about 3 to 10 percent loose stones. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but large stones or boulders have not been cleared from the surface and the soil lacks a plow layer. Included in mapping are a few small wet areas, a few small areas of bedrock outcrop, a few small areas of Lackawanna channery silt loam, and a few small acres of deep, well drained soil that does not have a fragipan.

This Lackawanna soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to slope, the slow permeability, and the surface stoniness. Capability subclass VIs.

LEF—Lackawanna and Bath very stony silt loams, steep. This steep and very steep mapping unit is in smooth, slightly convex areas on the sides of hills, valleys, and foot slopes of mountain ridges. About 60 percent of the total acreage is Lackawanna soil; 20 percent Bath soil; and 20 percent is minor soils, mostly Oquaga, Lordstown, and Arnot soils. Some areas are entirely Lackawanna soil or Bath soil, or any combination of the two. Loose stones cover about 3 to 15 percent of the surface. Runoff is rapid, and the hazard of erosion is slight.

The profile of the Lackawanna soil is similar to the one described as representative of the series, but this

soil has stones on the surface. The profile of the Bath soil is similar to the one described as representative of the series. Depth to bedrock in both soils is about 4 feet.

Because of the steep slopes, this mapping unit has not been investigated as thoroughly as the less sloping Lackawanna or Bath soils, and it contains more inclusions than those units.

Natural fertility is medium, and content of organic matter is moderate. Because of surface stones and slope, this unit is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, or esthetic uses. The steep and very steep slopes restrict the use of some woodland equipment.

Most areas are in woodland. Most limitations for nonfarm use are related to slope, the slow permeability, and the surface stoniness. Capability subclass VIIs.

Leck Kill Series

The Leck Kill series consists of deep, well drained, gently sloping to moderately steep soils. These soils are on the uplands and low ridges and knolls of broad, rolling intermountain basins. They formed in moderately thick old glacial till material derived from shale, siltstones, and sandstone.

In a representative profile, the surface layer is dusky red channery silt loam about 10 inches thick. The subsoil is weak red channery silty clay loam about 17 inches thick. The underlying material is weak red very channery silt loam about 21 inches thick. Fractured shale and sandstone is at a depth of 48 inches.

These soils have fractured or rippable bedrock at a depth of 48 inches. Permeability is moderately rapid, and available water capacity is moderate to high.

Representative profile of Leck Kill channery silt loam, 3 to 8 percent slopes, in Black Creek Township about 7 miles west of Conyngham:

Ap—0 to 10 inches; dusky red (2.5YR 3/2) channery silt loam; weak fine and very fine granular structure; friable, nonsticky, nonplastic; many small roots; 20 percent coarse fragments; medium acid; abrupt smooth boundary.

B21t—10 to 18 inches; weak red (10R 4/4) channery silty clay loam; moderate medium and fine blocky structure; friable, slightly sticky, slightly plastic; many small roots; 25 percent coarse fragments; thin patches of silt films on ped faces; medium acid; gradual wavy boundary.

B22t—18 to 27 inches; weak red (10YR 5/4) channery silty clay loam; moderate medium and fine angular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 35 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—27 to 48 inches; weak red (10R 4/3) very channery silt loam; moderate medium and fine angular blocky structure; friable, slightly sticky, slightly plastic; few small roots; 85 percent coarse fragments of soft sandstone; thin patches of clay films on surfaces of coarse fragments; very strongly acid; diffuse wavy boundary.

R—48 inches; weak red (10R 4/3) fractured sandstone and shale.

Solum thickness ranges from 24 to 40 inches. Depth to bedrock ranges from 3½ to 5 feet. The content of coarse fragments ranges from 15 to 25 percent in the Ap horizon, from 15 to 40 percent in the B2t horizon, and from 60 to 90 percent in the C horizon. Reaction ranges from neutral in the Ap horizon in limed areas to very strongly acid in the A and Bt horizons and from very strongly acid to medium acid in the C horizon. Color in the B2 horizon ranges from yellowish red (5YR 5/6) to dusky red (10R 3/4). The fine earth texture of the B2t horizon is silt loam, loam, or silty clay loam. Color in the C horizon is similar to that in the B2 horizon.

Leck Kill, Kedron, Klinesville, and Meckesville soils formed in similar material. Leck Kill soils do not have a fragipan and are not mottled, whereas Kedron soils have a fragipan and mottles within a depth of 30 inches. Leck Kill soils are 48 inches deep to bedrock and do not have a Bx horizon, and Meckesville soils are more than 5 feet deep to bedrock and have a Bx horizon. Leck Kill soils have a thicker solum than Klinesville soils.

LkB—Leck Kill channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on smooth, slightly convex uplands and the tops of low hills and ridges of broad, rolling intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping, in the southern part of the county, are a few small areas of a moderately deep, well drained soil that has a yellowish brown subsoil underlain by soft, olive gray shale bedrock. Also included are a few small areas of a soil that has more coarse fragments and less clay in the subsoil.

This Leck Kill soil is medium to high in natural fertility and low in content of organic matter. This soil is easily tilled during most of the year. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces and stripcropping are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas are in cultivated crops or hay. Some areas are in permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the depth to bedrock. Capability subclass IIe.

LkC—Leck Kill channery silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, slightly convex upland positions on the sides of low hills and ridges of broad, rolling intermountain basins. Runoff is medium to rapid, and the hazard of erosion is moderate.

Included with this soil in mapping, in the southern part of the county, are a few small areas of a moderately deep, well drained soil that has a yellowish brown subsoil underlain by soft, olive gray shale bedrock. Also included are a few small areas of a soil that has more coarse fragments and less clay in the subsoil.

This Leck Kill soil is medium to high in natural fertility and low in content of organic matter. It is easily tilled during most of the year. Erosion is a moderate to severe hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas are in cultivated crops, hay, or pasture. A few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope and the depth to bedrock. Capability subclass IIIe.

LkD—Leck Kill channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on the sides of

low hills, knolls, ridges, and valleys of broad, rolling intermountain basins. Runoff is rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but depth to bedrock is about 3½ feet. Included in mapping, in the southern part of the county, are a few small areas of a moderately deep, well drained soil that has a yellowish brown subsoil underlain by soft, olive gray shale bedrock. Also included are a few small areas of a soil that has more coarse fragments and less clay in the subsoil.

This Leck Kill soil is medium to high in natural fertility and low in content of organic matter. It is easily tilled during most of the year. Erosion is a severe hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas are in hay or permanent pasture. A few areas are used occasionally for cultivated crops, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope and the depth to bedrock. Capability subclass IVe.

Linden Series

The Linden series consists of deep, well drained, nearly level soils on flood plains. These soils formed in mixed alluvial material deposited by streams.

In a representative profile, the surface layer is dark reddish gray silt loam about 9 inches thick. The subsoil is reddish brown silt loam and very fine sandy loam about 26 inches thick. The substratum to a depth of 60 inches is reddish brown sandy loam and very gravelly sand.

Permeability is moderately rapid, and available water capacity is high. These soils are subject to occasional flooding.

Representative profile of Linden silt loam, in an area of Linden soils, in Huntington Township near the village of Harveyville about 100 feet east of Huntington Creek:

Ap—0 to 9 inches; dark reddish gray (5YR 4/2) silt loam; weak fine subangular blocky structure; friable, nonsticky, nonplastic; many small roots; less than 1 percent gravel; strongly acid; abrupt smooth boundary.

B1—9 to 17 inches; reddish brown (5YR 4/3) silt loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; less than 1 percent gravel; thin patches of clay films in pores; medium acid; gradual wavy boundary.

B2—17 to 35 inches; reddish brown (5YR 4/3) very fine sandy loam; weak medium subangular blocky structure; very friable, nonsticky, nonplastic; common small roots; less than 1 percent gravel; thin continuous clay films in pores; medium acid; gradual wavy boundary.

C1—35 to 45 inches; reddish brown (5YR 4/3) sandy loam with lenses of leached white sand grains; massive; very friable, nonsticky, nonplastic; few small roots; less than 1 percent gravel; strongly acid; gradual wavy boundary.

IIC2—45 to 60 inches; reddish brown (5YR 4/3) very gravelly sand; single grained; loose, nonsticky, nonplastic; 55 percent gravel; medium acid.

Solum thickness ranges from 24 to 40 inches. Depth to bedrock is 5 feet or more. The content of coarse fragments ranges from 0 to 10 percent in the A and B2 horizons, from 0 to 25 percent in the C horizon above 40 inches, and from 0 to 70 percent in the C horizon below 40 inches. In unlimed areas reaction ranges from extremely acid to medium acid throughout the profile. Texture in the A horizon is silt loam, loam, or fine sandy loam. Color in the B horizon ranges from reddish brown (2.5YR 5/4) to dark reddish brown (5YR 3/3). Some pedons have individual horizons with a hue of 7.5YR. Texture in the B horizon is silt loam, loam, fine sandy loam, or sandy loam. Colors in the B and C horizons are similar, but the C horizon also has a hue of 7.5YR and 10YR. The fine earth texture in the C horizon ranges from loam to sand, but texture is coarser than sandy loam below a depth of 40 inches.

Linden, Basher, Holly, Wayland, and Pope soils formed in similar material. Linden and Pope soils are well drained, Basher soils are moderately well drained and somewhat poorly drained, Holly soils are poorly drained, and Wayland soils are very poorly drained. Linden soils have a less yellow hue in the upper 40 inches than Pope soils.

Ln—Linden soils. These are nearly level soils on smooth or slightly convex flood plains. Slopes are 0 to 3 percent. The surface layer is very fine sandy loam, loam, and silt loam. Runoff is slow, and the hazard of erosion is slight.

The silt loam part of this unit has the profile described as representative of the Linden series. Included in mapping are a few small areas that have been gouged and scoured during stream overflow.

These soils are medium to high in natural fertility and moderate in content of organic matter. They have few limitations for cultivated crops and can be farmed intensively. Flooding is the main limitation to most uses. A history of flooding frequency is needed to determine the severity of the flood hazard.

These soils are suited to most crops commonly grown in the county. Most areas are used for hay or cultivated crops. Some areas are in woodland. Most limitations for nonfarm use are related to the occasional flooding of adjacent streams. Capability class I.

Lordstown Series

The Lordstown series consists of moderately deep, well drained, gently sloping to very steep soils. These soils are on the convex tops and sides of the hills, knolls, and mountain ridges of broad, rolling mountaintops and intermountain basins. They formed in moderately thick glacial till material derived from sandstone and conglomerate.

In a representative profile, the surface layer is dark grayish brown channery silt loam about 8 inches thick. The subsoil is yellowish brown channery silt loam about 19 inches thick. The underlying material to a depth of 30 inches is yellowish brown very channery silt loam. Olive gray sandstone bedrock is at a depth of 30 inches.

These soils have bedrock within a depth of 40 inches. Permeability is moderate, and available water capacity is low to very low.

The Lordstown soils in Luzerne County are mapped only with Oquaga soils.

Representative profile of Lordstown channery silt loam, in an area of Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes, in Kingston Township about 1½ miles southwest of Dallas:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate very fine and fine granular structure; very friable, nonsticky, slightly plastic; many small roots; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21—8 to 18 inches; yellowish brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; very friable, slightly sticky, slightly plastic; common small roots; 15 percent coarse fragments; strongly acid; gradual wavy boundary.

B22—18 to 27 inches; yellowish brown (10YR 5/4) channery silt loam; weak very fine and fine subangular blocky structure; very friable, slightly sticky, slightly plastic; common small roots; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—27 to 30 inches; yellowish brown (10YR 5/4) very channery silt loam; weak, massive; very friable, slightly sticky, nonplastic; few small roots; 50 percent coarse fragments; very strongly acid; abrupt wavy boundary.

R—30 inches; olive gray thin bedded sandstone.

Solum thickness and depth to bedrock range from 20 to 40 inches. The content of coarse fragments ranges from 15 to 35 percent in the A and B horizons and from 20 to 60 percent in the C horizon. The fine earth texture throughout the profile is loam or silt loam. Reaction ranges from very strongly acid to slightly acid in the A horizon and from very strongly acid to medium acid in the B and C horizons. Color in the B horizon ranges from dark brown (7.5YR 4/4) or brown (10YR 4/3) to light olive brown (2.5Y 5/6) Color in the C horizon ranges from dark brown (7.5YR 3/2) to light olive brown (2.5Y 5/6).

Lordstown, Oquaga, Mardin, Bath, and Volusia soils formed in similar material. Lordstown soils are similar to Oquaga soils in depth and drainage, but they are yellower.

Mardin Series

The Mardin series consists of deep, moderately well drained, gently sloping to moderately steep soils. These soils are on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. They formed in thick glacial till material derived from sandstone and shale.

In a representative profile, the surface layer is dark brown channery silt loam about 8 inches thick. The upper 11 inches of the subsoil is light olive brown channery silt loam and channery loam, and the lower 31 inches is firm and brittle, yellowish brown, and dark yellowish brown channery loam. The underlying material to a depth of 64 inches is yellowish brown channery loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow in the fragipan. Available water capacity is low to moderate.

Representative profile of Mardin channery silt loam, 3 to 8 percent slopes, in Union Township about 1½ miles south of Muhlenburg:

Ap—0 to 8 inches; dark brown (10YR 4/3) channery silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; many small roots; 20 percent coarse fragments; medium acid; abrupt smooth boundary.

B21—8 to 17 inches; light olive brown (2.5Y 5/4) channery silt loam; weak very fine and fine subangular blocky structure; friable, slightly sticky, slightly plastic; common roots; 25 percent coarse fragments; medium acid; gradual wavy boundary.

B22—17 to 19 inches; light olive brown (2.5Y 5/4) channery loam; many medium and coarse distinct light gray (10YR 7/2) and strong brown (7.5YR 5/6) mottles; weak very fine and fine subangular blocky structure; friable, slightly sticky, slightly plastic; few roots; 15 percent coarse fragments; medium acid; clear broken boundary.

Bx1—19 to 26 inches; yellowish brown (10YR 5/4) channery loam, light gray (2.5Y 7/2) prism faces; few fine faint mottles, dark brown (7.5YR 4/4) prism interior; weak very coarse prismatic structure parting to weak fine and medium subangular blocky; firm, brittle, slightly sticky, slightly plastic; few roots; 20 percent coarse fragments; medium acid; gradual wavy boundary.

Bx2—26 to 39 inches; brown (10YR 5/3) channery loam, light gray (N 7/0) prism faces; many medium prominent light gray (10YR 7/1) and strong brown (7.5YR 5/6) streaks and mottles; moderate very coarse prismatic structure parting to weak fine and medium blocky; firm, brittle, sticky, plastic; few roots along prism faces; common fine black (N 2/0) coatings on ped faces and a yellowish brown (10YR 5/4) horizontal streak at the base of the horizon; 20 percent coarse fragments; medium acid; gradual wavy boundary.

Bx3—39 to 43 inches; yellowish brown (10YR 5/4) channery loam, light gray (10 YR 7/1) prism faces; weak very coarse prismatic structure parting to weak fine medium subangular blocky; firm, brittle, slightly sticky, slightly plastic; 5-millimeter thick strong brown (7.5YR 5/6) horizontal streak across the horizon; 20 percent coarse fragments; medium acid; gradual wavy boundary.

Bx4—43 to 50 inches; dark yellowish brown (10YR 4/4) channery loam, light gray (N 7/0) prism faces; common coarse distinct strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to weak fine and medium subangular blocky; firm, brittle, slightly sticky, slightly plastic; common fine black (N 2/0) coatings on ped faces; thin clay films around pores; 25 percent coarse fragments; medium acid; gradual wavy boundary.

IIC—50 to 64 inches; yellowish brown (10 YR 5/4) channery loam; massive; friable, nonsticky, nonplastic; 30 percent coarse fragments; medium acid.

Solum thickness ranges from 40 to 70 inches. Depth to the Bx horizon ranges from 16 to 26 inches. Depth to bedrock is 6 feet or more. The content of coarse fragments ranges from 10 to 35 percent above the Bx horizon and from 20 to 50 percent in the Bx and C horizons. Reaction ranges from very strongly acid to medium acid above the Bx horizon and from very strongly acid to slightly acid in the Bx horizon. Color in the B2 horizon ranges from strong brown (7.5YR 5/6) to olive brown (2.5Y 4/4) and brown (10YR 5/3). This horizon has high and low chroma mottles between depths of 15 and 26 inches. The fine earth texture of the B2 horizon ranges from loam to silt loam. Color in the Bx and C horizons ranges from dark brown (7.5YR 3/2) to light olive brown (2.5Y 5/4). These horizons have faint to prominent mottles and streaks. The fine earth texture of the Bx horizon is silt loam or loam. The fine earth texture of the C horizon ranges from silt loam to loam.

Mardin, Bath, Lordstown, Volusia, and Chippewa soils formed in similar material. Mardin soils are deep and moderately well drained, Bath soils are deep and well drained, Lordstown soils are moderately deep and well drained, Volusia soils are deep and somewhat poorly drained, and Chippewa soils are deep and poorly drained and very poorly drained.

MaB—Mardin channery silt loam, 3 to 8 percent

slopes. This gently sloping soil is on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Mardin very stony silt loam and a few small areas of poorly drained and very poorly drained soils.

This Mardin soil is medium in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops or hay (fig. 5). Some areas are used for permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability. Capability subclass IIw.

MaC—Mardin channery silt loam, 8 to 15 percent slopes. This sloping soil is on smooth, slightly concave uplands on the crests of hills and knolls and at the base of the steeper areas of broad, rolling mountaintops and intermountain basins. Runoff is medium to rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 6 inches thick. Included in mapping are a few small areas of Mardin very stony silt loam and a few small areas of poorly drained or very poorly drained soils.

This Mardin soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops and hay. Some areas are used for permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and slope. Capability subclass IIIe.

MaD—Mardin channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on the narrow

Figure 5.—**Pasture and hayland on Mardin channery silt loam, 3 to 8 percent slopes, in the foreground. Bath soils are on the ridge in the background.**

sides of hills, knolls, and valleys and at the base of the steeper areas of broad, rolling mountaintops and intermountain basins. Runoff is rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 6 inches thick and depth to the fragipan is about 16 inches. Included in mapping are a few small areas of Mardin very stony silt loam and a few small areas of poorly drained and very poorly drained soils. Also included are a few small areas of Volusia channery silt loam.

This Mardin soil is medium in natural fertility and low in content of organic matter. Erosion is a severe hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for hay and pasture and occasionally for cultivated crops. A few small areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and slope. Capability subclass IVe.

McB—Mardin very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. The surface area is about 3 to 10 percent loose stones. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface and the soil has no plow layer. Included in mapping are a few small areas of Mardin channery silt loam and a few small areas of poorly drained and very poorly drained soils.

This Mardin soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and the surface stoniness. Capability subclass VIs.

McD—Mardin very stony silt loam, 8 to 25 percent sloping. This sloping and moderately steep soil is on smooth or slightly concave uplands on the crests and sides of hills and knolls and at the base of the steeper areas of broad, rolling mountaintops and intermountain basins. The surface area is about 3 to 10 percent loose stones. Runoff is medium to rapid, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface and the soil has no plow layer. Included in mapping are a few small areas of Mardin channery silt loam and a few small areas of poorly drained and very poorly drained soils.

This Mardin soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, slope, and the surface stoniness. Capability subclass VIs.

Meckesville Series

The Meckesville series consists of deep, well drained, gently sloping to moderately steep soils. These soils are on the uplands of broad, rolling intermountain basins. They formed in thick old glacial till material derived from sandstone, siltstone, and shale.

In a representative profile, the surface layer is dark reddish brown channery silt loam about 8 inches thick. The subsoil to a depth of 60 inches is 27 inches of dark reddish brown and reddish brown silt loam and channery silt loam and 25 inches of firm and brittle, reddish brown channery silt loam.

The fragipan in these soils restricts downward movement of roots. Permeability is moderately slow, and available water capacity is moderate.

Representative profile of Meckesville channery silt loam, 3 to 8 percent slopes, in Black Creek Township about 5½ miles west of Conyngham:

Ap—0 to 8 inches; dark reddish brown (5YR 3/3) channery silt loam; moderate fine and very fine granular structure; very friable, slightly sticky, slightly pastic; many small roots; 15 percent shale fragments; very strongly acid; abrupt smooth boundary.

B21—8 to 15 inches; dark reddish brown (5YR 3/3) silt loam; weak medium and fine blocky structure; friable, slightly sticky, slightly plastic; many small roots; 10 percent shale fragments; very strongly acid; gradual wavy boundary.

B22—15 to 18 inches; reddish brown (5YR 4/3) channery silt loam; weak medium blocky structure; friable, slightly sticky, slightly plastic; common small roots; 20 percent shale fragments; very strongly acid; clear wavy boundary.

B23t—18 to 26 inches; reddish brown (5YR 4/3) silt loam; moderate medium subangular blocky structure parting to very fine angular blocky; friable, slightly sticky, slightly plastic; common small roots; 10 percent shale fragments; thin patches of clay films on ped faces; strongly acid; gradual wavy boundary.

B24t—26 to 35 inches; reddish brown (2.5YR 4/4) silt loam; moderate medium angular blocky structure; friable, slightly sticky, slightly plastic; few small roots; 10 percent shale fragments; thin patches of clay films on ped faces; strongly acid; clear wavy boundary.

Bx—35 to 60 inches; reddish brown (2.5YR 4/4) channery silt loam; weak very coarse prismatic structure parting to moderate medium angular blocky; firm, brittle, slightly sticky, slightly plastic; few small roots; 40 percent shale fragments; few black (N 2/0) coatings on ped faces; thick patches of clay films in pores; strongly acid.

Solum thickness ranges from 40 to 75 inches. Depth to bedrock is 5 feet or more. Depth to the Bx horizon ranges from 28 to 36 inches. The content of coarse fragments ranges from 10 to 30 percent above the Bx horizon and from 20 to 50 percent in the Bx horizon. In unlimed areas reaction is extremely acid or very strongly acid throughout the profile. Color in the B2 and B2t horizons ranges from dark reddish brown (5YR 3/3) to red (10R 4/6). The fine earth texture is silt loam, loam, or silty clay loam. Color in the Bx horizon ranges from weak red (10R 4/4) to dusky red (2.5YR 3/2). Texture ranges from loam to silt loam.

Meckesville, Leck Kill, and Kedron soils formed in similar material. Meckesville and Leck Kill soils are deep and well drained, and Kedron soils are deep and moderately well drained and somewhat poorly drained. Meckesville soils have a fragipan, and Leck Kill soils do not.

MeB—Meckesville channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly convex uplands of broad, rolling intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

This soil has profile described as representative of the series. Included in mapping are a few small areas of Meckesville very stony silt loam, a few small areas of Lackawanna soils, and a few small wet areas.

This Meckesville soil is medium to high in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of trees and large stones and are used for cultivated crops and hay. A few areas are used for permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the moderately slow permeability and the content of coarse fragments. Capability subclass IIe.

MeC—Meckesville channery silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, slightly convex upland positions on the crests of hills and knolls of broad, rolling intermountain basins. Runoff is medium to rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 6 inches thick and depth to the fragipan is about 30 inches. Included in mapping are a few small areas of Meckesville very stony silt loam, a few small areas of Lackawanna soils, and a few small wet areas.

This Meckesville soil is medium to high in natural fertility and low in content of organic matter. Erosion is a moderate to severe hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of trees and large stones and are used for cultivated crops and hay. Some areas are in permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the moderately slow permeability and slope. Capability subclass IIIe.

MeD—Meckesville channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on the smooth, slightly convex sides of hills and valleys of broad, rolling intermountain basins. Runoff is rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 6 inches thick and depth to the fragipan is about 30 inches. Included in mapping are a few small areas of Meckesville very stony silt loam and a few small wet areas.

This Meckesville soil is medium to high in natural fertility and low in content of organic matter. Erosion is a severe hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, and a crop rotation that includes mostly close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of trees and large stones and are used for hay and pasture and occasionally for cultivated crops. A few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope, the moderately slow permeability, and the content of coarse fragments. Capability subclass IVe.

MfB—Meckesville very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly convex uplands of broad, rolling intermountain basins. Loose stones cover about 1 to 5 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface. Included in mapping are a few small areas of Meckesville channery silt loam, a few small areas of Lackawanna soils, and a few small wet areas.

This Meckesville soil is medium to high in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the moderately slow permeability and the surface stoniness. Capability subclass VIs.

MfD—Meckesville very stony silt loam, 8 to 25 percent slopes. This sloping and moderately steep soil is on the sides of hills and valleys and at the base of the mountain ridges of broad, rolling intermountain basins. Loose stones cover about 1 to 5 percent of the surface. Runoff is medium to rapid, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been

removed from the surface and the soil has no plow layer. Included in mapping are a few small areas of Meckesville channery silt loam, a few small areas of Lackawanna soils, and a few small wet areas.

This Meckesville soil is medium to high in natural fertility and moderate in content of organic matter. Because of the surface, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the moderately slow permeability, slope, and the surface stoniness. Capability subclass VIs.

Mine Dump

Mine dump consists of nearly level to very steep, dark colored carbonaceous waste products of the coal mining industry. The waste material is piled near the coal processing plant.

Anthracite coal is removed from the earth by either surface or subsurface mining techniques and transported to a processing plant where the high quality coal is separated from the carbonaceous rock and low quality coal. The mine dump material, or waste, ranges in size from a fraction of an inch to 6 or 8 inches in diameter.

Most of this material has enough carbonaceous material so that it burns under intense heat. Some of the larger mine dumps ignited by spontaneous combustion have smouldered for years, emitting hydrogen sulfide fumes into the air. The burned material either burns itself out or is extinguished mechanically. It is a reddish white flaky shale and cinderlike material.

Mg—Mine dump. This nearly level to very steep, unconsolidated, dark colored, low quality coal and rock material is a waste product of the coal mining industry. Runoff is slow to very rapid. Extremely acid sulphur compound leachates are common in some of these dumps.

Included with Mine dump in mapping are a few areas of Strip mine and Mine wash. Also included are a few areas of Urban land; Urban land, rarely flooded; and Cut and Fill land.

As a result of extreme acidity, low fertility, and other undesirable features, this material has very little vegetative cover and little value for farming. It is best suited to wildlife habitat, recreation, or esthetic use.

On site investigation is needed to determine the suitability, hazards, and degree of limitation for any intended use.

Mh—Mine dump, burned. This nearly level to very steep, mixed reddish white and dark colored, cinderlike dump is a burned waste product from the coal mining industry. Runoff is slow to very rapid.

Included in mapping are a few areas of Mine dump, Strip mine, and Mine wash. Also included are a few areas of Urban land; Urban land, rarely flooded; and Cut and Fill land.

Mine dump, burned, is carbonaceous material that ignited by spontaneous combustion. In some places the material is loose and flaky, and in others it is baked into large hard masses. Because fertility is low, the dump generally supports very little vegetation. It has no value for farming and is generally not suitable for recreation or other use. Some of this material is used for road fill.

Onsite investigation is needed to determine the suitability, hazards, and degree of limitation for any intended use.

Mm—Mine wash. This nearly level, unconsolidated, dark colored, fine textured material is a coal waste product. Runoff is slow, and ponding is common.

Included with Mine wash in mapping are a few small areas of Mine dump and Strip mine.

Mine wash forms during the breaking, sizing, and washing of anthracite coal. The wash water is piped into a settling basin where the fine coal particles settle out and the water evaporates or is drained off. Embankments for desilting basins are usually constructed from mine dump material. Mine wash has little or no value for farming. Many areas are being reclaimed and used for fuel in electrical power generating plants.

Onsite investigation is needed to determine the suitability hazards and degree of limitation for any intended use.

Morris Series

The Morris series consists of deep, somewhat poorly drained, nearly level to sloping soils. These soils are in the smooth, concave depressions and drainageways of broad, rolling mountaintops and intermountain basins. They formed in thick glacial till material derived from sandstone and shale.

The top 3 inches in a representative profile is an organic layer of recently deposited and partly decomposed leaf litter. The surface layer is about 4 inches of dark reddish brown channery silt loam. The subsoil to a depth of 60 inches is 12 inches of mottled reddish brown and gray loam and 44 inches of firm and brittle, mottled reddish brown and weak red channery silt loam and channery loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate to low.

Representative profile of Morris channery silt loam, in a wooded area of Morris very stony silt loam, 0 to 8 percent slopes, in Bear Creek Township about 1¼ miles northwest of Pleasant View Summit Lake:

O1—3 to 2 inches; recently deposited leaf litter.
O2—2 inches to 0; black (5YR 2/1) partly decomposed organic material.
A1—0 to 4 inches; dark reddish brown (5YR 3/2) channery silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; many small and medium roots; 40 percent coarse fragments; very strongly acid; clear wavy boundary.
B21—4 to 8 inches; reddish brown (5YR 5/3) loam; common fine and medium distinct strong brown (7.5YR

5/6) mottles; weak medium angular blocky structure; friable, slightly sticky, slightly plastic; many small and medium roots; 10 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22—8 to 16 inches; gray (5YR 6/1) loam; common medium distinct reddish brown (5YR 5/3) and strong brown (7.5YR 5/6) mottles; weak medium angular blocky structure; firm, slightly sticky, plastic; many small and medium roots between ped faces; few fine black (N 2/0) coatings on ped faces; 10 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx1—16 to 30 inches; reddish brown (5YR 5/3) channery silt loam, thick light gray (5YR 6/1) prism faces; common medium prominent light gray (5YR 6/1) and strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to weak thick platy; firm, brittle, slightly sticky, plastic; few fine roots along prism faces; 15 percent coarse fragments; few thin patchy clay films along prism faces; strongly acid; gradual wavy boundary.

Bx2—30 to 60 inches; weak red (2.5YR 5/2) channery loam, light gray (5YR 6/1) prism faces; common medium distinct reddish brown (5YR 5/3) and strong brown (7.5YR 5/6) mottles; weak very coarse prismatic structure parting to weak coarse angular blocky; firm, brittle, slightly sticky, slightly plastic; few fine roots along prism faces; 30 percent coarse fragments; few thin patchy clay films along prism faces; common fine black (N 2/0) coatings on ped faces; medium acid.

Solum thickness ranges from 40 to 75 inches or more. Depth to bedrock is 5 feet or more. Depth to the Bx horizon ranges from 13 to 22 inches. Reaction ranges from very strongly acid to medium acid in the A horizon, B2 horizon, and upper part of the Bx horizon and from strongly acid to slightly acid in the lower part of the Bx horizon and in the C horizon. The content of coarse fragments ranges from 10 to 40 percent above the Bx horizon and from 15 to 50 percent in the Bx and C horizons. The fine earth texture of the A, B2, and Bx horizons is loam or silt loam. Color in the B2 horizon dominantly ranges from gray (5YR 5/1) to light gray (10YR 7/2), but color in individual subhorizons ranges from dark reddish brown (5YR 3/2) to light yellowish brown (10YR 6/4). These subhorizons have gray and brown mottles. Color in the Bx horizon ranges from weak red (2.5YR 4/2) to brown (7.5YR 5/4). This horizon commonly has gray or brown mottles. Prism faces are generally coated with gray (N 5/0, 5YR 5/1) to light gray (10YR 7/2) or pale brown (10YR 6/3).

Morris, Lackawanna, Wellsboro, and Chippewa soils formed in similar material. Morris soils are somewhat poorly drained, Lackawanna soils are well drained, Wellsboro soils are moderately well drained, and Chippewa soils are poorly drained and very poorly drained.

MoB—Morris channery silt loam, 0 to 8 percent slopes. This nearly level and gently sloping soil is in the smooth, concave depressions and drainageways of broad, rolling mountaintops and intermountain basins. Runoff is slow, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but stones have been removed from the surface. Included in mapping are a few small areas of Morris very stony silt loam and a few small areas of poorly drained and very poorly drained soils.

This Morris soil is medium in natural fertility and low in content of organic matter. The seasonal high water table delays tillage in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion in gently sloping areas.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in hay or permanent pasture. A few areas are in cultivated crops, and some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability. Capability subclass IIIw.

MoC—Morris channery silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, concave upland positions in drainageways or at the base of the steeper, better drained soils on broad, rolling mountaintops and in intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but stones have been removed from the surface. Included in mapping are a few small areas of Morris very stony silt loam.

This Morris soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in hay or permanent pasture. A few areas are in cultivated crops, and some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope, the seasonal high water table, and the slow permeability. Capability subclass IIIe.

MsB—Morris very stony silt loam, 0 to 8 percent slopes. This nearly level and gently sloping soil is in the smooth, concave depressions and drainageways of broad, rolling mountaintops and intermountain basins. Loose stones cover about 3 to 10 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Morris channery silt loam and a few small areas where stones cover more than 10 percent of the surface.

This Morris soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields. The seasonal high water table restricts the use of some woodland equipment.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the slow permeability, the seasonal high water table, and the surface stoniness. Capability subclass VIIs.

MsC—Morris very stony silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, concave upland

positions in drainageways or at the base of steeper, better drained soils on broad, rolling mountaintops and in intermountain basins. The surface area is about 3 to 10 percent loose stones. Runoff is medium, and the hazard of erosion is slight.

Included with this soil in mapping are a few small areas of Morris channery silt loam and a few small areas where stones cover more than 10 percent of the surface.

This Morris soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields. The seasonal high water table restricts the use of some woodland equipment.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the slow permeability, the seasonal high water table, slope, and the surface stoniness. Capability subclass VIIs.

Muck

Mu—Muck consists of very poorly drained, level and nearly level organic soils. These soils are in low lying, concave depressions of broad, rolling mountaintops and intermountain basins. They formed in decaying organic deposits 5 to 30 feet thick. Runoff is slow, and ponding is common. The hazard of erosion is slight.

These organic soils have a black surface layer. The underlying organic layers are very dark gray, very dark grayish brown, dark brown, very dark brown, and dark reddish brown. The material is fibric, hemic, or sapric.

Included with Muck in mapping are a few small areas of Muck that is 10 to 36 inches thick over contrasting mineral soils or bedrock.

Permeability is moderately rapid, and available water capacity is high. Natural fertility is medium to low, and content of organic matter is extremely high. Because of the high water table, these soils are generally not suited to cultivated crops. If drained, however, they are suited to certain high cash value truck crops.

Most areas of Muck are in woodland or wetland shrubs. Organic material from several of the larger bogs is sold commercially for mushroom culture and landscaping purposes. Most limitations for nonfarm use are related to the high water table, ponding, the difficulty in locating suitable drainage outlets, and the possibility of subsidence if the material is excessively drained and as it continues to decay.

Oquaga Series

The Oquaga series consists of moderately deep, well drained, gently sloping to very steep soils. These soils are on the convex tops and sides of hills, knolls, and mountain ridges of broad, rolling mountaintops and intermountain basins. They formed in moderately thick glacial till material weathered from sandstone, shale, and conglomerate.

The top 3 inches in a representative profile is an organic layer of recently deposited and partly decomposed leaf litter. The surface layer is 4 inches of dark reddish brown channery silt loam. The subsoil is dark reddish brown and dark red channery silt loam, channery loam, and very channery loam about 26 inches thick. The underlying material to a depth of 35 inches is dark reddish brown very channery loam. Shale bedrock is at a depth of 35 inches.

These soils have bedrock within a depth of 40 inches. Permeability is moderate, and available water capacity is moderate to low.

Representative profile of Oquaga channery silt loam, in an area of Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes, in Bear Creek Township about 2 miles south of the Wilkes-Barre interchange of Northeast Pennsylvania Turnpike along State Route 115:

O1—3 to 2 inches; recently deposited leaf litter.
O2—2 inches to 0; black (5YR 2/1) partly decomposed organic material.
A1—0 to 4 inches; dark reddish brown (2.5YR 3/4) channery silt loam; weak and very fine granular structure; friable, nonsticky, nonplastic; many small roots; 15 percent coarse fragments; very strongly acid; clear wavy boundary.
B1—4 to 9 inches; dark reddish brown (2.5YR 3/4) channery silt loam; weak very fine subangular blocky structure; friable, slightly sticky, slightly plastic; many small roots; 20 percent coarse fragments; strongly acid; clear wavy boundary.
B21—9 to 18 inches; dark red (2.5YR 3/6) channery silt loam; weak very fine subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 30 percent coarse fragments; strongly acid; clear wavy boundary.
B22—18 to 26 inches; dark reddish brown (2.5YR 3/4) channery loam; weak very fine and fine subangular blocky structure; friable, slightly sticky, nonplastic; few small roots; 40 percent coarse fragments; strongly acid; clear wavy boundary.
B3—26 to 30 inches; dark reddish brown (2.5YR 3/4) very channery loam; weak very fine and fine subangular blocky structure; friable, slightly sticky, nonplastic; few small roots; 60 percent coarse fragments; strongly acid; clear wavy boundary.
C—30 to 35 inches; dark reddish brown (2.5YR 3/4) very channery loam; massive, silt within interstices of the shale fragments; friable, slightly sticky, nonplastic; 85 percent shale fragments; very strongly acid; abrupt wavy boundary.
R—35 inches; dark reddish gray shale.

Solum thickness ranges from 15 to 35 inches. Depth to bedrock ranges from 20 to 40 inches. The content of coarse fragments ranges from 15 to 50 percent in the solum and from 60 to 90 perecnt in the C horizon. In unlimed areas reaction is very strongly acid or strongly acid throughout the profile. Color in the B horizon ranges from dark reddish brown (2.5YR 3/4) to strong brown (7.5YR 5/6). The fine earth texture in the B and C horizons is silt loam or loam. In some pedons faint mottles are at the point of contact with bedrock.

Oquaga, Arnot, Lackawanna, and Wellsboro soils formed in similar material. Oquaga soils are moderately deep and well drained. Arnot soils are shallow and well drained, Lackawanna soils are deep and well drained, and Wellsboro soils are deep and moderately well drained.

O1B—Oquaga and Lordstown channery silt loams,

3 to 8 percent slopes. This gently sloping mapping unit is on the convex tops of the hills, knolls, and mountain ridges of broad, rolling mountaintops and intermountain basins. About 60 percent of the total acreage is Oquaga soil, and 30 percent is Lordstown soil. Some mapped areas are entirely Oquaga soil. Some are Lordstown soil. Runoff is medium.

The Lordstown soil has the profile described as representative of the series. The Oquaga soil has a profile similar to the one described as representative of the series, but stones have been removed from the surface.

Included with this unit in mapping are a few small areas of a deep, moderately well drained soil that does not have a fragipan; a few small areas of Oquaga and Lordstown extremely stony silt loams; and a few small wet areas. Also included is rock outcrop, which in places makes up about 2 to 10 percent of the surface area.

Natural fertility is medium, and content of organic matter is low. Erosion is a moderate hazard if this unit is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This mapping unit is suited to most shallow rooted crops commonly grown in the county. It is generally not suited to cultivated crops in places where rock outcrop is common. It is better suited to permanent hay or pasture. Most areas are used for permanent hay, pasture, or woodland. Some areas are used for cultivated crops, and some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the depth to bedrock. Capability subclass IIe.

O1C—Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes. This sloping mapping unit is on the convex, rounded tops, crests, and sides of the hills, knolls, and mountain ridges of broad, rolling mountaintops and intermountain basins. About 60 percent of the total acreage is Oquaga soil, and about 30 percent is Lordstown soil. Some mapped areas are entirely Oquaga soil. Some are Lordstown soil. Runoff is medium to rapid, and the hazard of erosion is moderate.

The Lordstown soil has a profile similar to the one described as representative of the series, but depth to bedrock is about 27 inches. The Oquaga soil has a profile similar to the one described as representative of the series, but stones have been removed from the surface.

Included with this unit in mapping are a few small areas of a deep, moderately well drained soil that does not have a fragipan, a few small areas of Oquaga and Lordstown extremely stony silt loams, and a few small wet areas. Also included is rock outcrop, which in places makes up about 5 to 15 percent of the surface area.

Natural fertility is medium, and content of organic matter is low. Erosion is a moderate to severe hazard if this unit is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This mapping unit is suited to most shallow rooted crops commonly grown in the county. It is generally not suited to cultivated crops in places where rock outcrop is common. It is better suited to permanent hay or pasture. Most areas are used for permanent hay, pasture, or woodland. A few small areas are used for cultivated crops, and some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the depth to bedrock and slopes. Capability subclass IIIe.

O1D—Oquaga and Lordstown channery silt loams, 15 to 25 percent slopes. This moderately steep mapping unit is on the sides of hills, knolls, and mountain ridges of broad, rolling mountaintops and intermountain basins. About 60 percent of the total acreage is Oquaga soil, and 30 percent is Lordstown soil. Runoff is rapid, and the hazard of erosion is moderate.

The Lordstown soil has a profile similar to the one described as representative of the series, but depth to bedrock about 24 inches. The Oquaga soil has a profile similar to the one described as representative of the series, but stones have been removed from the surface.

Included with this unit in mapping are a few small areas of Oquaga and Lordstown extremely stony silt loams and a few small wet areas. Also included is rock outcrop, which in places makes up about 5 to 15 percent of the surface area.

Natural fertility is medium, and content of organic matter is low. Erosion is a severe hazard if this unit is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly close growing grasses and legumes are needed to control erosion.

This mapping unit is suited to most shallow rooted crops commonly grown in the county. It is generally not suited to permanent hay or pasture. Most limitations for nonfarm use are related to the depth to bedrock and slope. Capability subclass IVe.

OpB—Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes. This gently sloping mapping unit is on the convex tops of the hills, knolls, and mountain ridges of broad, rolling mountaintops and intermountain basins. About 60 percent of the total acreage is Oquaga soil, and 30 percent is Lordstown soil. Some mapped areas are entirely Oquaga soil. Some are only Lordstown soil. Loose stones cover about 15 to 25 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

The Lordstown soil has a profile similar to the one described as representative of the series, but stones have not been removed from the surface. The Oquaga soil has a profile similar to the one described as representative of the series.

Included with this unit in mapping are a few small areas of a deep, moderately well drained soil without a fragipan; a few small areas of Oquaga and Lordstown channery silt loams; and a few small wet areas. Also included is rock outcrop, which in places makes up about 2 to 10 percent of the surface area.

Natural fertility is medium, and content of organic matter is moderate. Because of the surface stones, this unit is not suited to cultivated crops or pasture. It is

better suited to woodland, wildlife habitat, recreation, or esthetic use. The extremely stony surface layer and rock outcrop restrict the use of some woodland equipment.

Most areas of this mapping unit are used for woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the depth to bedrock and the surface stoniness. Capability subclass VIIs.

OpD—Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes. This sloping and moderately steep mapping unit is on the convex, rounded tops, crests, and sides of hills; on knolls; and on the mountain ridges of broad, rolling mountains and intermountain basins. About 55 percent of the total acreage is Oquaga soil and 30 percent is Lordstown soil. Some mapped areas are entirely Oquaga soil. Some are Lordstown soil. Loose stones cover about 15 to 25 percent of the surface. Runoff is medium to rapid, and the hazard of erosion is slight.

The Lordstown soil has a profile similar to the one described as representative of the Lordstown series, but stones have not been removed from the surface. The Oquaga soil has the profile described as representative of the Oquaga series.

Included with this unit in mapping are a few small areas of a deep, moderately well drained soil without a fragipan; a few small areas of Oquaga and Lordstown channery silt loams; and a few small wet areas. Also included is rock outcrop, which in places makes up about 5 to 15 percent of the surface area.

Natural fertility is medium, and content of organic matter is moderate. Because of the surface stones, this unit is not suited to cultivated crops or to pasture. It is better suited to woodland, wildlife habitat, recreation, or esthetic use. The extremely stony surface layer and rock outcrop restrict the use of some woodland equipment.

Most areas of this mapping unit are used for woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the depth to bedrock, the surface stoniness, and slope. Capability subclass VIIs.

OXF—Oquaga and Lordstown extremely stony silt loams, steep. This steep and very steep mapping unit is on the sides of hills, mountain ridges, and valleys of broad, rolling mountaintops and intermountain basins. About 55 percent of the total acreage is Oquaga soil, and 30 percent is Lordstown soil. Some mapped areas are entirely Oquaga soil. Some are Lordstown soil. Loose stones cover about 5 to 30 percent of the surface. Runoff is rapid to very rapid, and the hazard of erosion is slight.

The Lordstown soil has a profile similar to the one described as representative of the series, but stones have not been removed from the surface. The Oquaga soil has a profile similar to the one described as representative of the series. Depth to bedrock is about 24 inches in both soils.

Because of the steep and very steep slopes, this mapping unit has not been investigated as thoroughly as most areas in the county, and it contains more inclusions than the less sloping Oquaga and Lordstown extremely stony silt loams mapping units. The most common inclusions are a few small areas of a deep, moderately well drained soil without a fragipan. Also included is rock outcrop, which in places makes up about 5 to 15 percent of the surface area.

Natural fertility is medium, and content of organic matter is moderate. Because of the steep and very steep slopes, this unit is not suited to cultivated crops. It is better suited to woodland, wildlife habitat, recreation, or esthetic use. The steep and very steep slopes and stones restrict the use of most woodland equipment.

Most areas of this mapping unit are used for woodland. Most limitations for nonfarm use are related to slope, the depth to bedrock, and the surface stoniness. Capability subclass VIIs.

Pocono Series

The Pocono series consists of deep, well drained, gently sloping to moderately steep soils. These soils are on the smooth, convex uplands of broad, rolling mountaintops and mountainsides. They formed in thick glacially influenced material derived from sandstone, conglomerate, and shale.

The top inch in a representative profile is an organic layer of partly decomposed leaf litter. The surface layer is about 1 inch of very dark brown gravelly loam. The subsurface layer is pinkish gray gravelly sandy loam about 4 inches thick. The subsoil to a depth of 65 inches is strong brown gravelly loam.

Permeability is moderate, and available water capacity is moderate to high.

Representative profile of Pocono gravelly sandy loam, in a wooded area of Pocono extremely stony sandy loam, 8 to 25 percent slopes, in Hazle Township about three-quarters of a mile southwest of the village of Japan along a coal haul road east of Legislative route 40004:

O2—1 inch to 0; black (N 2/0) partly decomposed organic material.

A1—0 to 1 inch; very dark brown (10YR 2/2) gravelly loam; moderate fine granular structure; very friable, nonsticky, nonplastic; many roots; 30 percent coarse fragments; very strongly acid; abrupt wavy boundary.

A2—1 to 5 inches; pinkish gray (7.5YR 6/2) gravelly sandy loam; weak coarse granular structure; very friable, nonsticky, nonplastic; many roots; 35 percent coarse fragments; very strongly acid; clear wavy boundary.

B21t—5 to 11 inches; strong brown (7.5YR 5/6) gravelly loam; weak fine subangular blocky structure; very friable, slightly sticky, slightly plastic; many roots; some clay bridging sand grains; 40 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—11 to 24 inches; strong brown (7.5YR 5/6) gravelly loam; weak fine subangular blocky structure; friable, slightly sticky, plastic; common roots; few thin clay films in pores and bridging sand grains; few thin black coatings; 50 percent coarse fragments; very strongly acid; gradual wavy boundary.

B23t—24 to 36 inches; strong brown (7.5YR 5/6) gravelly loam; weak fine and medium subangular blocky structure; friable, slightly sticky, plastic; common roots; common thin clay films in pores and bridging

sand grains; 50 percent coarse fragments; very strongly acid; gradual wavy boundary.

B24t—36 to 57 inches; strong brown (7.5YR 5/6) gravelly loam; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common thin clay films in pores and on peds; few black coatings; 45 percent coarse fragments; very strongly acid; gradual wavy boundary.

B3—57 to 65 inches; strong brown (7.5YR 5/6) gravelly loam; weak medium subangular blocky structure; friable, slightly sticky, plastic; common thin clay films in pores and on fragments; 45 percent coarse fragments; very strongly acid.

Solum thickness ranges from 40 to 70 inches. Depth to bedrock is 6 feet or more. The content of coarse fragments ranges from 15 to 40 percent in the A horizon and from 15 to 50 percent in the B2 and B2t horizons. In unlimed areas reaction ranges from extremely acid to strongly acid throughout the profile. The fine earth texture of the B2 and B2t horizons is loam or sandy loam. Color in the B2 horizon ranges from brown (7.5YR 5/4) to brownish yellow (10YR 6/6).

Pocono, Dekalb, Alvira, Buchanan, and Shelmadine soils formed in similar material. Pocono soils have bedrock at a depth of 6 feet or more, and Dekalb soils have bedrock within 20 to 40 inches. Pocono soils are better drained than Alvira, Buchanan, and Shelmadine soils.

PoB—Pocono gravelly sandy loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly convex uplands and hills of broad, rolling mountaintops and ridges. Runoff is slow, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but stones have been removed from the surface. Included in mapping are a few small areas of Dekalb soils and a few small areas of Pocono extremely stony sandy loam.

This Pocono soil is low in natural fertility and content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of trees and large stones and are used mostly as building sites. Most limitations for nonfarm use are related to the content of coarse fragments. Capability subclass IIIs.

PoC—Pocono gravelly sandy loam, 8 to 15 percent slopes. This sloping soil is on the smooth, slightly convex uplands and hills of broad, rolling mountaintops and ridges. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but stones have been removed from the surface. Included in mapping are a few small areas of Dekalb soils and a few small areas of Pocono extremely stony sandy loam.

This Pocono soil is low in natural fertility and content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most crops commonly grown in the county. Most areas have been cleared of trees and large stones and are used mostly as building sites. Most limitations for nonfarm use are related to slope and the content of coarse fragments. Capability subclass IIIe.

PpB—Pocono extremely stony sandy loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly convex uplands and hills of broad, rolling mountaintops and ridges. Loose stones cover 15 to 25 percent of the surface. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series. Included in mapping are a few small areas of Dekalb soils and a few small areas of Pocono gravelly sandy loam.

This Pocono soil is low in natural fertility and content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops or pasture. It is better suited to woodland, wildlife habitat, recreation, or esthetic use.

Most areas of this soil are used for woodland, which is of poor quality. Most limitations for nonfarm use are related to the surface stoniness. Capability subclass VIIs.

PpD—Pocono extremely stony sandy loam, 8 to 25 percent slopes. This sloping and moderately steep soil is on the smooth, slightly convex hills and ridges of broad, rolling mountaintops and intermountain basins. Loose stones cover 15 to 25 percent of the surface. Runoff is medium, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Dekalb soils, rock outcrop, and Pocono gravelly sandy loam.

This Pocono soil is low in natural fertility and content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops or pasture. It is better suited to woodland, wildlife habitat, recreation, or esthetic use.

Most areas of this soil are used for woodland, which is of poor quality. Most limitations for nonfarm use are related to slope and the surface stoniness. Capability subclass VIIs.

Pope Series

The Pope series consists of deep, well drained, nearly level to gently sloping soils on high bottom flood plains. These soils formed in mixed alluvial material deposited by rivers and streams.

In a representative profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is brown and dark brown silt loam about 32 inches thick. The substratum to a depth of 62 inches is dark brown and brown loam.

Permeability is moderate or moderately rapid, and available water capacity is high to moderate. These soils are subject to occasional flooding.

Representative profile of Pope silt loam, in an area of Pope soils, in the city of Nanticoke about three-quarters of a mile west of Nanticoke bridge:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam with intermixing or dark brown (10YR 4/3)

from B horizon below; moderate medium and coarse granular structure; very friable, slightly sticky, slightly plastic; many small roots; slightly acid; clear smooth boundary.

B21—10 to 21 inches; brown (10YR 4/3) silt loam ped face, dark brown (10YR 4/3) ped interior; moderate coarse subangular blocky structure; very friable, slightly sticky, plastic; common small roots; few thin clay films in pores; medium acid; gradual wavy boundary.

B22—21 to 34 inches; dark brown (10YR 4/3) silt loam ped face, dark brown (7.5YR 4/4) ped interior; moderate coarse subangular blocky structure; friable, slightly sticky, plastic; few small roots; common thin clay films in pores and thin patches on ped faces; medium acid; gradual wavy boundary.

B3—34 to 42 inches; brown (10YR 4/3) silt loam ped face, dark brown (10YR 4/3) ped interior; weak coarse subangular blocky structure; friable, slightly sticky, plastic; few thin clay films in pores; strongly acid; gradual wavy boundary.

C1—42 to 57 inches; dark brown (10YR 4/3) loam; white (10YR 8/2) leached sand grains in pores; massive; friable, slightly sticky, slightly plastic; few very thin clay films in pores; strongly acid; gradual wavy boundary.

C2—57 to 62 inches; brown (10YR 5/3) loam; massive; friable, slightly sticky, slightly plastic; few thin clay films in pores; strongly acid.

Solum thickness ranges from 30 to 50 inches. In unlimed areas reaction ranges from extremely acid to strongly acid. Texture in the solum is silt loam, loam, fine sandy loam, or sandy loam. Texture in the C horizon is loam, sandy loam, or loamy sand. Color in the B and C horizons ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6).

Pope, Basher, Holly, Linden, and Wayland soils formed in similar material. Pope soils have no low chroma mottles and Basher, Holly, and Wayland soils have low chroma mottles within a depth of 24 inches. Pope and Linden soils are both well drained, but Linden soils have a hue of 5YR or redder in the solum.

Ps—Pope soils. These nearly level to gently sloping soils are on smooth, slightly convex high bottom flood plains. Slopes are 0 to 5 percent. The surface layer is silt loam, loam, or fine sandy loam. These soils are subject to occasional flooding. Runoff is slow, and the hazard of erosion is none to slight.

Included with these soils in mapping are a few small areas of Linden soils and a few small wet areas in gouged depressions.

These soils are high in natural fertility and moderate to low in content of organic matter. They have few limitations to use and can be farmed intensively. Occasional flooding is the main limitation to most uses. A history of flooding frequency is needed to determine the severity and frequency of the flood hazard.

This soil is suited to most crops (fig. 6) commonly grown in the county. Most areas are used for cultivated crops, mainly truck crops. A few areas are used for hay and woodland. Some areas along the Susquehanna and Lackawanna Rivers are in urban use. Most limitations for nonfarm use are related to the flood hazard. Capability class I.

Rexford Series

The Rexford series consists of deep, somewhat poorly drained and poorly drained, nearly level and gently sloping soils. These soils are in smooth, low lying, con-

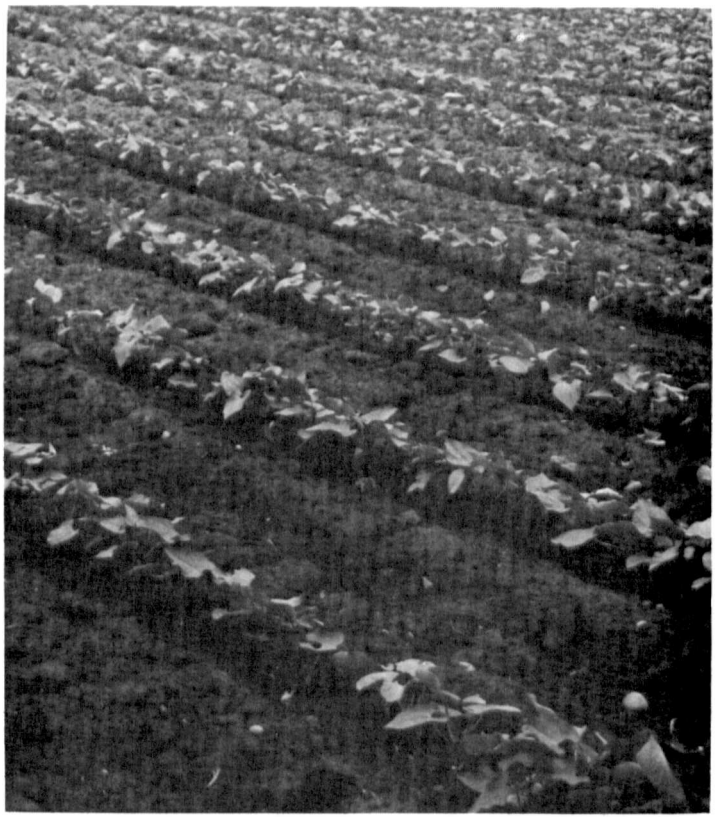

Figure 6.—Crop of soybeans replanted on Pope soils shortly after flooding.

cave depressions on glacial outwash terraces. They formed in thick sediments from glacial ice deposits.

In a representative profile, the surface layer is dark grayish brown loam about 9 inches thick. The upper 9 inches of the subsoil is very firm and brittle, mottled light brownish gray loam, and the lower 19 inches is very firm and brittle, mottled light brownish gray loam. The substratum to a depth of 60 inches is light brownish gray and brown gravelly loam and very gravelly loamy sand.

The fragipan in these soils restricts the downward movement of roots and water. Permeability is slow in the fragipan. Available water capacity is moderate.

Representative profile of Rexford loam, 0 to 3 percent slopes, in Salem Township about 1 mile northeast of U.S. Highway 11 and the village of Beach Haven:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam; weak very fine granular structure; very friable, nonsticky, nonplastic; many fine roots; less than 1 percent rounded gravel; strongly acid; abrupt smooth boundary.

B21—9 to 13 inches; pale brown (10YR 6/3) loam; few medium distinct yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; less than 1 percent gravel; medium acid; gradual wavy boundary.

B22—13 to 18 inches; light brownish gray (10YR 6/2) loam; few medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky struc-

ture; friable, slightly sticky, slightly plastic; common small roots; 1 percent gravel; medium acid; clear wavy boundary.

Bx—18 to 37 inches; light brownish gray (10YR 6/2) loam, gray (10YR 6/1) prism faces; common medium prominent reddish brown (5YR 4/4) mottles; weak very coarse prismatic structure parting to weak coarse subangular blocky; very firm, brittle, slightly sticky, slightly plastic; few roots along prism faces; few fine black (N 2/0) coatings on ped faces; 10 percent gravel; medium acid; clear wavy boundary.

IIC1—37 to 50 inches; light brownish gray (10YR 6/2) gravelly loam; common medium distinct strong brown (7.5YR 5/6) and dark yellowish brown (10YR 3/4) mottles; massive; friable, nonsticky, nonplastic; few fine roots; few fine black (N 2/0) coatings on ped faces; 45 percent gravel and cobbles; medium acid; gradual wavy boundary.

IIC2—50 to 60 inches; brown (10YR 4/3) very gravelly loamy sand; few medium faint yellowish brown (10YR 5/4) mottles; single grained; loose, nonsticky, nonplastic; few fine roots; 55 percent gravel and cobbles; medium acid.

Solum thickness ranges from 24 to 50 inches. Stratified sand and gravel is at a depth of 35 to 60 inches. Depth to bedrock is 6 feet or more. Depth to the Bx horizon ranges from 15 to 24 inches. The content of coarse fragments ranges from 0 to 40 percent in individual horizons. In unlimed areas reaction ranges from very strongly acid to medium acid above the Bx horizon and from strongly acid to slightly acid in the Bx and C horizons. The fine earth texture in the A and B horizons is loam, sandy loam, or silt loam. The C horizon ranges from loam to stratified sand and gravel. The B2 horizon has a dominant chroma of 2 or less. It ranges from brown (7.5YR 4/2) or gray (10YR 5/1) to light yellowish brown (2.5Y 6/4) and has gray or brown mottles. The B21 horizon of some pedons has no mottling. Color in the Bx horizon ranges from light brownish gray (2.5Y 6/2) to dark brown (7.5YR 4/4) and is mottled with gray or brown. Color in the C horizon ranges in hue from 2.5Y to 7.5YR.

Rexford, Braceville, Chenango, and Wyoming soils and the Atherton variant formed in similar material. Rexford soils are somewhat poorly drained and poorly drained, Braceville soils are moderately well drained, Chenango soils are well drained, Wyoming soils are somewhat excessively drained, and the Atherton variant is poorly drained and very poorly drained. Rexford soils have a fragipan, and the Atherton variant and Chenango and Wyoming soils do not.

RdA—Rexford loam, 0 to 3 percent slopes. This nearly level soil is in smooth, concave positions on glacial outwash terraces. Runoff is slow, and the hazard of erosion is none to slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Rexford soils where the surface layer is more than 15 percent gravel and a few small areas of the Atherton variant.

This Rexford soil is medium to low in natural fertility and low in content of organic matter. The seasonal high water table delays tillage in spring and during wet periods. Artificial drainage is needed to remove excess water and improve use and management. Diversion terraces are needed to divert runoff from some adjacent areas. The seasonal high water table restricts the use of some woodland equipment.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for hay or permanent pasture. Some areas are used for cultivated crops, and a few areas left idle are reverting to brush and trees. Other areas are in woodland. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability. Capability subclass IIIw.

RdB—Rexford loam, 3 to 8 percent slopes. This gently sloping soil is in smooth, slightly concave positions on glacial outwash terraces. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series. Included in mapping are a few small areas of Rexford soils where the surface layer is more than 15 percent gravel and a few small areas of the Atherton variant.

This Rexford soil is medium to low in natural fertility and low in content of organic matter. The seasonal high water table delays tillage in spring and during wet periods. Artificial drainage is needed to remove excess water and improve use and management. Diversion terraces are needed to divert runoff from some adjacent areas. Contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for hay or permanent pasture. Some areas are used for cultivated crops, and a few areas left idle are reverting to brush and trees. Other areas are in woodland. Most limitations for nonfarm use are related to the seasonal high water table and the slow permeability. Capability subclass IIIw.

Shelmadine Series

The Shelmadine series consists of deep, poorly drained, nearly level and gently sloping soils on old glacially influenced uplands. These soils are in low lying depressional areas on broad, rolling mountaintops. They formed in old glacial till more than 5 feet thick.

The top 2 inches in a representative profile is an organic layer of undecomposed and partly decomposed leaf litter. The surface layer is 2 inches of black silt loam. The subsoil to a depth of 60 inches is 18 inches of mottled grayish brown and light gray silt loam and gravelly silt loam and 40 inches of firm and brittle, grayish brown gravelly clay loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate.

Representative profile of Shelmadine silt loam, 0 to 5 percent slopes, in Butler Township about 1¼ miles west of Freeland:

O1—2 inches to 1 inch; recently deposited leaf litter.

O2—1 inch to 0; dark reddish brown (5YR 2/2) partly decomposed organic material.

A1—0 to 2 inches; black (10YR 2/1) silt loam; weak fine granular structure; very friable, nonsticky, nonplastic; many fine and medium roots; 5 percent coarse fragments; extremely acid; abrupt wavy boundary.

B21g—2 to 8 inches; grayish brown (10YR 5/2) silt loam ped exterior, gray (10YR 6/1) ped interior; weak fine subangular blocky structure; friable, slightly sticky, slightly plastic; common small and medium roots; few fine black (N 2/0) concretions; 5 percent coarse fragments; extremely acid; clear wavy boundary.

B22tg—8 to 20 inches; light gray (10YR 6/1) gravelly heavy silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; common small roots; 20 percent coarse fragments; few thin patchy clay films on ped faces and lining pores; extremely acid; clear wavy boundary.

Bx1g—20 to 40 inches; grayish brown (2.5Y 5/2) gravelly clay loam, light gray (10YR 6/1) prism faces and dark grayish brown (10YR 4/2) ped faces; common fine distinct yellowish brown (10YR 5/6) and yellowish red (5YR 4/8) mottles and root stains; moderate very coarse prismatic structure, weak thick platy structure in prism interior; firm, brittle, sticky, plastic; few fine roots along prism faces; 25 percent coarse fragments; few thin patchy clay films on prism faces and around pores; very strongly acid; gradual wavy boundary.

Bx2g—40 to 60 inches; grayish brown (2.5Y 5/2) gravelly clay loam, light gray (10YR 6/1) prism faces and dark grayish brown (10YR 4/2) ped faces; common fine distinct yellowish brown (10YR 5/6) and yellowish red (5YR 4/8) mottles and root stains; modderate very coarse prismatic structure, weak thick platy structure in prism interior; firm, brittle, sticky, plastic; few fine roots along prism faces; 25 percent coarse fragments; few thin patchy clay films on prism faces; strongly acid.

Solum thickness ranges from 40 to 60 inches. Depth to the Bx horizon ranges from 18 to 30 inches. Depth to bedrock is 5 feet or more. In unlimed areas reaction ranges from strongly acid to extremely acid throughout the profile. The content of coarse fragments ranges from 5 to 25 percent in the solum. The fine earth texture ranges from silt loam in the A horizon and upper part of the B2g horizon to silty clay loam in the B2t horizon and clay loam or loam in the Bx horizon. The B2 horizon ranges from gray (10YR 5/1) to light yellowish brown (2.5Y 6/4) and has gray, grayish brown, strong brown, and yellowish brown mottles. Gleying begins below the A1 horizon. Color in the Bx horizon ranges from brown (7.5YR 4/2) to light yellowish brown (2.5Y 6/4). Color of mottles and coatings on faces of peds is similar to that of the B2 horizon.

Shelmadine, Alvira, and Buchanan soils formed in similar material. Shelmadine soils are poorly drained, Alvira soils are somewhat poorly drained, and Buchanan soils are moderately well drained.

ShA—Shelmadine silt loam, 0 to 5 percent slopes. This nearly level and gently sloping soil is in smooth, concave depressions and drainageways on broad, rolling mountaintops and at the base of mountain ridges. Runoff is slow, and the hazard of erosion is slight.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Shelmadine very stony silt loam.

This Shelmadine soil is medium to low in natural fertility and moderate to low in content of organic matter. Because of the high water table, tillage is delayed in spring or during wet periods. If these soils are used for cultivated crops, artificial drainage is needed to remove excess water and improve use and management. Diversion terraces are needed to divert runoff from some adjacent areas. The high water table restricts the use of some woodland equipment during wet periods.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in woodland or wetland shrubs, but a few small areas are in urban uses. Most limitations for nonfarm use are related to the high water table and the slow permeability. Capability subclass IVw.

SkB—Shelmadine very stony silt loam, 0 to 5 percent slopes. This nearly level to gently sloping soil is in the smooth, concave depressions and drainageways in broad, rolling mountaintops and at the base of mountain ridges. The surface area is about 3 to 15 percent loose stones. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but this soil has stones on the surface. Included in mapping are a few small areas of Shelmadine silt loam. Also included are a few small areas of Shelmadine soils where less than 3 percent of the surface is covered with stones and a few where more than 15 percent is covered with stones.

This Shelmadine soil is medium to low in natural fertility and moderate to low in content of organic matter. Because of surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. If this soil is used for permanent pasture, artificial drainage may be needed to improve use and management. The high water table restricts the use of some woodland equipment during wet periods.

Most areas of this soil are in woodland or wetland shrubs. Most limitations for nonfarm use are related to the high water table, the slow permeability in the subsoil, and the surface stones. Capability subclass VIIs.

Strip Mine

Sm—Strip mine is a nearly level to very steep mixture of the bedrock and unconsolidated soil and rock material through surface mining to expose anthracite coal. Runoff is slow to very rapid, and the hazard of erosion is moderate to severe. Most areas are extremely acid.

Included with Strip mine in mapping are a few areas of Mine dump, Mine wash, Urban land, and Cut and Fill land. Also included are small areas of the soils generally mapped in the two major fields in the county.

Strip mining involves the removal of soil and rock overburden to expose a coal seam. Heavy earth moving equipment is used to excavate a nearly vertical trench, one side of which is generally an exposed, vertical or nearly vertical wall of bedrock. The loose soil and rock overburden removed from the trench is piled on the opposite side.

Many of the older strip mines are steep and very steep piles of unconsolidated soil, broken rock material, and exposed bedrock. Vegetation on these older mines varies, depending on the length of time the material has been exposed to weathering and the amount of soil material suitable for plant growth.

Recent strip mine legislation requires that recently excavated strip mines are to be regraded to about the original contour and reseeded to control erosion after the coal has been removed. A few areas of Strip mine near established communities have been regraded and are used as building sites. Onsite investigation is needed to determine the suitability, hazards, and degree of limitations of Strip mine.

Urban Land

Urban land is a nearly level to moderately steep mixture of soil, rock, and miscellaneous manmade material. It is in industrial, commercial, and some residential areas where urban structures and works so obscure the land surface that identification of the soils is not practical. Most areas are on uplands or terraces, but some are on flood plains.

In many places the original soil profile has been completely destroyed, but in some scattered areas the soils remain intact. Urban land is used as sites for shopping centers, schools, factories, railroads, homes, and other urban and industrial facilities. The largest areas are between West Pittston and Nanticoke near the Susquehanna River and, in the southern part of the county, in Hazleton.

Ub—Urban land is on smooth or slightly convex uplands. It is nearly level to moderately steep. Runoff is slow to rapid. The surface layer in most areas is stabilized artificially or with vegetation. If the surface cover is inadequate, the hazard of erosion is severe.

Included with Urban land in mapping are a few areas of Mine dump, Strip mine, and Cut and Fill land and a few small areas of soils adjacent to Urban land.

Most areas of Urban land are in the closely built-up sections of communities. Onsite investigation is needed to determine the suitability, hazards, and degree of limitations before selecting an area for a specific use.

Uf—Urban land, rarely flooded, is on smooth or slightly concave flood plains. It is nearly level to gently sloping. The soil material consists of water-laid sediments. Color and texture are variable. Runoff is slow to rapid. The surface layer in most areas is stabilized artificially or with vegetation. If the surface cover is inadequate, the hazard of erosion is moderate.

Included with Urban land, rarely flooded, in mapping are a few areas of Mine dump, some areas of Pope and Basher soils, and a few small sand and gravel quarries that have been filled with trash.

Onsite investigation is needed to determine the flooding frequency before selecting an area for a specific use.

Volusia Series

The Volusia series consists of deep, somewhat poorly drained, nearly level to sloping soils. These soils are in the smooth, concave depressions and drainageway of broad, rolling mountaintops and intermountain basins. They formed in thick glacial till material weathered from sandstone and shale.

In a representative profile, the surface layer is dark grayish brown channery silt loam about 9 inches thick. The subsoil to a depth of 60 inches is 11 inches of mottled pale olive and light olive gray channery silt loam and channery heavy silt loam and 40 inches of very firm and brittle, olive channery loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is very slow in the fragipan. Available water capacity is moderate.

Representative profile of Volusia channery silt loam, 0 to 8 percent slopes, in Union Township about three-quarters of a mile southwest of Muhlenburg:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) channery silt loam; moderate very fine and fine granular structure; very friable, nonsticky, slightly plastic; many small roots; 25 percent coarse fragments; slightly acid; abrupt smooth boundary.

B21—9 to 15 inches; pale olive (5Y 6/3) channery silt loam; few medium distinct yellowish brown (10YR 5/8) mottles and dark grayish brown (10YR 4/2) stains in earthworm channels; weak fine and medium subangular blocky structure; friable, nonsticky, slightly plastic; common small roots; 30 percent coarse fragments; thin continuous clay films in root pores and earthworm channels; slightly acid; gradual wavy boundary.

B22—15 to 20 inches; light olive gray (5Y 6/2) channery heavy silt loam; common coarse and medium distinct yellowish brown (10YR 5/8) and gray (5Y 6/1) mottles; weak fine and medium angular blocky structure; friable to slightly firm, slightly sticky, plastic; few small roots; 15 percent coarse fragments; thin continuous clay films in root pores and earthworm channels; strongly acid; clear wavy boundary.

Bx—20 to 60 inches; olive (5Y 5/3) channery loam, light gray (5Y 6/1) prism faces; many medium prominent yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to weak medium and coarse angular blocky; very firm, brittle, nonsticky, nonplastic; few fine roots along prism faces; 30 percent coarse fragments; few thin clay films on prism faces and around pores and stone faces; slightly acid.

Solum thickness ranges from 40 to 72 inches. Depth to the Bx horizon ranges from 10 to 20 inches. In unlimed areas reaction ranges from very strongly acid to slightly acid above the Bx horizon and from medium acid to slightly acid in the Bx horizon. The content of coarse fragments ranges from 15 to 30 percent in the solum and from 30 to 60 in the C horizon. The fine earth texture in the solum is loam or silt loam. The B2 horizon ranges from light yellowish brown (10YR 6/4) to olive gray (5Y 4/2), but a chroma of 2 or less is dominant in the lower part of the B2 horizon, just above the Bx horizon. Color in the Bx horizon ranges from very dark grayish brown (10YR 3/2) to olive (5Y 5/4).

Volusia, Chippewa, Mardin, Wurtsboro, and Bath soils formed in similar material. Volusia soils are somewhat poorly drained. Chippewa soils are poorly drained and very poorly drained, Mardin and Wurtsboro soils are moderately well drained, and Bath soils are well drained.

VoB—Volusia channery silt loam, 0 to 8 percent slopes. This nearly level and gently sloping soil is in the smooth, concave depressions and drainageways of broad, rolling mountaintops and intermountain basins. Runoff is slow to medium, and the hazard of erosion is moderate.

In most areas this soil has the profile described as representative of the series, but the Volusia soils near Wurtsboro soils are slightly coarser textured throughout the profile than those near Mardin soils. Included in mapping are a few small areas of Volusia very stony silt loam and a few small areas of poorly drained and very poorly drained soils.

This Volusia soil is medium in natural fertility and low in content of organic matter. The seasonal high water table delays tillage in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Contour stripcropping, minimum tillage,

and a crop rotation that includes close growing grasses and legumes are needed to control erosion in steeper areas.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in hay or permanent pasture. A few small areas are used for cultivated crops, and some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table and the very slow permeability. Capability subclass IIIw.

VoC—Volusia channery silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, concave upland positions in drainageways or at the base of steeper, better drained soils of broad, rolling mountaintops and intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

In most areas the profile of this soil is similar to the one described as representative of the series, but the Volusia soils near Wurtsboro soils are slightly coarser textured throughout the profile than those near Mardin soils. Included in mapping are a few small areas of Volusia very stony silt loam and a few small areas of poorly drained and very poorly drained soils.

This Volusia soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in hay or permanent pasture. A few small areas are in cultivated crops, and some areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to slope, the seasonal high water table, and the very slow permeability. Capability subclass IIIe.

VrB—Volusia very stony silt loam, 0 to 8 percent slopes. This nearly level to gently sloping soil is in the smooth, concave depressions and drainageways of broad, rolling mountaintops and intermountain basins. The surface area is about 3 to 10 percent loose stones. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface and the soil has no plow layer. The Volusia soils near Wurtsboro soils are slightly coarser textured throughout the profile than those near Mardin soils. Included in mapping are a few small areas of Volusia channery silt loam and a few small areas of poorly drained and very poorly drained soils.

This Volusia soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields. The seasonal high water table restricts the use of some woodland equipment.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the very slow permeability, and the surface stoniness. Capability subclass VIIs.

VrC—Volusia very stony silt loam, 8 to 15 percent slopes. This sloping soil is in smooth, concave upland positions in drainageways or at the base of steeper, better drained soils of broad, rolling mountaintops and intermountain basins. The surface area is about 3 to 10 percent loose stones. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface and the soil has no plow layer. The Volusia soils near Wurtsboro soils are slightly coarser textured throughout the profile than those near Mardin soils. Included in mapping are a few small areas of Volusia channery silt loam and a few small areas of poorly drained and very poorly drained soils.

This Volusia soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields. The seasonal high water table restricts the use of some woodland equipment.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the very slow permeability, slope, and the surface stoniness. Capability subclass VIIs.

Wayland Series

The Wayland series consists of deep, very poorly drained, nearly level soils on flood plains. These soils formed in mixed alluvial material deposited by streams.

In a representative profile, the surface layer is very dark grayish brown silt loam about 3 inches thick. The substratum to a depth of 60 inches is mottled gray and olive gray silty clay loam and heavy silty clay loam.

Permeability is slow, and available water capacity is high. The water table is at or near the surface during wet periods.

Representative profile of Wayland silt loam, in Lake Township about 1¼ miles northeast of the village of Pike's Creek. Slope is less than 1 percent:

A1g—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, gray (10YR 5/1) rubbed and dry; moderate very fine granular structure; very friable, nonsticky, nonplastic; neutral; abrupt wavy boundary.

C1g—3 to 35 inches; gray (5Y 6/1) silty clay loam; many medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles; weak stratification or weak medium and thick platy structure; friable, sticky, plastic; thin continuous clay films in pores; neutral; gradual wavy boundary.

C2g—35 to 42 inches; gray (5Y 5/1) silty clay loam; few fine prominent yellowish red (5YR 4/6) mottles and stains around old root channels; massive; friable, sticky, plastic; neutral; gradual wavy boundary.

C3g—42 to 60 inches; olive gray (5Y 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) stains and mottles around old root channels; massive; friable, sticky, plastic; neutral.

Depth to contrasting gravelly or sandy material is greater than 60 inches. Reaction is neutral or mildly alkaline. Texture of the solum is silt loam or silty clay loam. The Cg horizon ranges from dark gray (5Y 4/1) to light gray (N 6/0) and has distinct to prominent mottles of higher chroma.

The Wayland soils in Luzerne County differ from the standards defined for the series in having a thinner, dark colored surface layer. This difference, however, does not alter the use, management, or behavior of these soils.

Wayland, Holly, Basher, Pope, and Linden soils formed in similar material. Wayland soils are very poorly drained. Holly soils are poorly drained, Basher soils are moderately well and somewhat poorly drained, and Pope and Linden soils are well drained.

Wa—Wayland silt loam. This nearly level soil is on smooth, slightly concave flood plains. It normally occupies flood plain positions along small streams and low lying concave basins along streams and rivers. Slopes are 0 to 3 percent. Runoff is slow. This soil is subject to frequent flooding and ponding. The hazard of erosion is none to slight.

Included with this soil in mapping are a few small areas of a very poorly drained soil that has a sand or loamy sand substratum below a depth of 12 to 14 inches.

This Wayland soil is medium in natural fertility and moderate in content of organic matter. The high water table and the hazard of flooding delay tillage during wet periods. Artificial drainage is needed to remove excess water and improve use and management. Flooding and the lack of suitable outlets for artificial drainage are the main limitations.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are in woodland or wetland shrubs. A few areas are in native wetland grasses. Most limitations for nonfarm use are related to the high water table and the frequent flooding. Capability subclass IVw

Weikert Series

The Weikert series consists of shallow, well drained, gently sloping to moderately steep soils. These soils are on the tops and sides of ridges, hills, and knolls of broad, rolling intermountain basins. They formed in thin glacial till material derived from shale, siltstone, and some sandstone.

In a representative profile, the surface layer is dark brown channery silt loam about 8 inches thick. The subsoil is dark brown channery silt loam about 6 inches thick. The subsoil is dark brown channery silt loam about 6 inches thick. The underlying material is dark brown very channery silt loam about 3 inches thick. Dark gray shale bedrock is at a depth of 17 inches.

These soils have a shallow root zone. Permeability is moderately rapid, and available water capacity is very low.

Representative profile of Weikert channery silt loam, from an area of Weikert and Klinesville channery silt loams, 3 to 8 percent slopes, in Union Township 1½ miles southwest of Muhlenburg:

Ap—0 to 8 inches; dark brown (10YR 4/3) channery silt loam; weak fine granular structure; friable, nonsticky, nonplastic; many small roots; 20 percent coarse fragments; strongly acid; clear smooth boundary

B2—8 to 14 inches; dark brown (7.5YR 4/4) channery silt loam; weak fine subangular blocky structure; friable, nonsticky, nonplastic; common small roots; 40 percent coarse fragments; strongly acid; gradual wavy boundary.

C—14 to 17 inches; dark brown (7.5YR 4/4) very channery silt loam in voids between coarse fragments; massive; friable, nonsticky, nonplastic; few small roots; 85 percent coarse fragments; strongly acid; clear wavy boundary.

R—17 inches; dark gray (10YR 4/1) weathered shale bedrock.

Solum thickness and depth to bedrock range from 10 to 20 inches. The content of coarse fragments ranges from 20 to 50 percent in the A horizon, from 30 to 65 percent in the B horizon, and from 60 to 85 percent in the C horizon. In unlimed areas reaction is very strongly acid or strongly acid throughout the profile. Color in the B and C horizons ranges from dark brown (10YR 4/3) to strong brown (7.5YR 5/6). Texture of the fine earth fraction is silt loam or loam.

Weikert, Arnot, and Klinesville soils formed in similar material. Weikert soils differ from Arnot soils in not having dominantly coarse grained sandstone and conglomerate coarse fragments throughout the profile. Weikert soils have a hue yellower than 7.5YR, and Klinesville soils have a hue redder than 5YR.

WeB—Weikert and Klinesville channery silt loams, 3 to 8 percent slopes. This gently sloping mapping unit is on the convex tops of hills, knolls, and ridges. About 60 percent of the total acreage is Weikert soil, and 30 percent is Klinesville soil. Mapped areas consist of Weikert soil, Klinesville soil, or both. Runoff is medium, and the hazard of erosion is moderate. Both soils have the profiles described as representative of their respective series.

Included with this unit in mapping are a few small areas of Arnot-Rock outcrop complex and a few small areas of Weikert and Klinesville soils where 1 to 3 percent of the surface is covered with stones.

Natural fertility and content of organic matter are low. Erosion is a moderate to severe hazard if this unit is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to reduce the risk of erosion.

This mapping unit is suited to most shallow rooted, drought-tolerant crops commonly grown in the county. Most areas left idle are reverting to brush and trees. A few small areas are used for permanent pasture or hay, and a few small areas have been quarried for shale. Most limitations for nonfarm use are related to the depth to bedrock and the content of coarse fragments. Capability subclass IIIe.

WeC—Weikert and Klinesville channery silt loams, 8 to 15 percent slopes. This sloping mapping unit is on the convex, rounded tops, crests, and sides of hills, knolls, and ridges. About 60 percent of the total acreage is Weikert soil, and 30 percent is Klinesville soil. Mapped areas consist of Weikert soil, Klinesville soil,

or both. Runoff is medium to rapid, and the hazard of erosion is moderate.

These soils have profiles similar to the ones described as representative of their respective series, but the surface layer is slightly thinner.

Included with this unit in mapping are a few small areas of Arnot-Rock outcrop complex and a few small areas of Weikert and Klinesville soils where 1 to 3 percent of the surface is covered with stones.

Natural fertility and content of organic matter are low. Erosion is a severe hazard if this unit is used for cultivated crops. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes mostly close growing grasses and legumes are needed to reduce the risk of erosion.

This mapping unit is suited to most shallow rooted, drought-tolerant crops commonly grown in the county. Most areas left idle are reverting to brush and trees. A few small areas are used for permanent pasture and hay, and a few areas have been quarried for shale. Most limitations for nonfarm use are related to the depth to bedrock and slope. Capability subclass IVe.

WeD—Weikert and Klinesville channery silt loams, 15 to 25 percent slopes. This moderately steep mapping unit is on the sides of hills, knolls, and ridges. About 60 percent of the total acreage is Weikert soil and 30 percent is Klinesville soil. Some mapped areas are entirely Weikert soil. Some are Klinesville soil. Runoff is rapid to very rapid, and the hazard of erosion is moderate.

These soils have profiles similar to the ones described as representative of their respective series, but the surface layer is slightly thinner and depth to bedrock is about 12 inches.

Included with this unit in mapping are a few small areas of Arnot-Rock outcrop complex and a few small areas of Weikert and Klinesville soils where 1 to 3 percent of the surface is covered with stones.

Natural fertility and content of organic matter are low. Because of the moderately steep slopes, shallowness to bedrock, and severe erosion hazard, this unit is not suited to cultivated crops. It is better suited to permanent hay or pasture.

This mapping unit is suited to most shallow rooted, drought-tolerant hay or pasture crops commonly grown in the county. Most areas left idle are reverting to brush and trees. A few small areas are used for permanent pasture and hay, and a few small areas have been quarried for shale. Most limitations for nonfarm use are related to slope and the depth to bedrock. Capability subclass VIe.

Wellsboro Series

The Wellsboro series consists of deep, moderately well drained, gently sloping to moderately steep soils. These soils are on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. They formed in thick glacial till material weathered from sandstone and shale.

In a representative profile, the surface layer is dark reddish gray channery silt loam about 10 inches thick. The subsurface layer is brown gravelly silt loam about 3 inches thick. The subsoil to a depth of 72 inches is 9 inches of mottled reddish brown channery light silt loam and 50 inches of very firm and firm, brittle, reddish brown channery silt loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate.

Representative profile of Wellsboro channery silt loam, 3 to 8 percent slopes, in Plymouth Township about three quarters of a mile north of Plymouth:

Ap—0 to 10 inches; dark reddish gray (5YR 4/2) channery silt loam; moderate fine and very fine granular structure; very friable, nonsticky, nonplastic; many small roots; 15 percent coarse fragments; slightly acid; abrupt smooth boundary.

A2—10 to 13 inches; brown (7.5YR 5/2) gravelly silt loam; weak medium platy structure parting to weak very fine subangular blocky; friable, slightly sticky, slightly plastic; many small roots; 15 percent coarse fragments; slightly acid, limed; gradual wavy boundary.

B2—13 to 22 inches; reddish brown (5YR 5/3) channery light silt loam; common medium distinct pinkish gray (5YR 7/2) and strong brown (7.5YR 5/6) mottles in lower part; moderate medium and fine angular blocky structure; friable, slightly sticky, nonplastic; common small roots; 15 percent coarse fragments; strongly acid; gradual wavy boundary.

Bx1—22 to 34 inches; reddish brown (5YR 4/3) channery silt loam, brown (7.5YR 5/2) prism faces and yellowish red (5YR 4/8) rinds; moderate very coarse prismatic structure parting to weak thick platy and fine angular blocky; very firm, brittle, slightly sticky, slightly plastic; few roots along prism faces; 20 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx2—34 to 50 inches; reddish brown (5YR 4/3) channery silt loam, pinkish gray (7.5YR 7/2) prism faces and strong brown (7.5YR 5/8) rinds; few fine faint yellowish red (5YR 5/8) mottles in prism interiors; moderate very coarse prismatic structure parting to weak very thick platy and medium angular blocky; very firm, brittle, slightly sticky, plastic; few small roots along prism faces; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx3—50 to 72 inches; reddish brown (5YR 4/3) channery silt loam, weak red (2.5YR 5/2) prism faces and strong brown (7.5YR 5/6) rinds; moderate very coarse prismatic structure parting to weak very thick platy and medium angular blocky; firm, brittle, slightly sticky, slightly plastic; few small roots along prism faces; 40 percent coarse fragments; strongly acid.

Solum thickness ranges from 40 to 75 inches or more. Depth to bedrock is 6 feet or more. Depth to the Bx horizon ranges from 18 to 26 inches. The content of coarse fragments ranges from 10 to 30 percent above the Bx horizon and from 15 to 50 percent in the Bx and C horizons. In unlimed areas reaction ranges from very strongly acid to medium acid throughout the profile. The fine earth texture of the B2 horizon is loam or silt loam. Some pedons have a thin A'2 horizon above the Bx horizon. This A'2 horizon is mottled fine sandy loam, loam, or silt loam. Color in the B2 horizon ranges from reddish brown (5YR 4/3 or 2.5YR 4/4) to yellowish brown (10YR 5/6). Gray or brown mottles are in some part of the B2 or A'2 horizon below 12 inches. The matrix of the Bx horizon ranges from weak red (2.5YR 4/2) to reddish brown (5YR 5/4). Prism faces range from weak red (2.5YR 4/2) to pink (5YR 7/3) or pinkish gray (7.5YR 7/2). The fine earth texture in the Bx horizon ranges from loam to silt loam. Color in the C horizon is similar to that in the Bx horizon. The fine earth texture ranges from sandy loam to loam.

Wellsboro, Lackawanna, Morris, and Chippewa soils formed in similar material. Wellsboro soils are moderately well drained, Lackawanna soils are well drained, Morris soils are somewhat poorly drained, and Chippewa soils are poorly drained and very poorly drained.

WlB—Wellsboro channery silt loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. Runoff is slow, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Wellsboro very stony silt loam and a few small wet areas.

This Wellsboro soil is medium in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces or artificial drainage is needed to remove excess water and improve use and management. Stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops or hay. Some areas are used for permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the content of coarse fragments, and the slow permeability. Capability subclass IIw.

WlC—Wellsboro channery silt loam, 8 to 15 percent slopes. This sloping soil is on smooth, slightly concave uplands at the crests of hills and knolls and at the base of the steeper areas of broad, rolling mountaintops and intermountain basins. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 6 to 8 inches thick. Included in mapping are a few small areas of Wellsboro very stony silt loam and a few small wet areas.

This Wellsboro soil is medium in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for cultivated crops and hay. Some areas are used for permanent pasture, and a few areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and slope. Capability subclass IIIe.

WlD—Wellsboro channery silt loam, 15 to 25 percent slopes. This moderately steep soil is on the smooth, slightly concave, narrow sides of hills, knolls, and valleys and at the base of the steeper areas of broad, rolling mountaintops and intermountain basins. Runoff is rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is about 6 inches thick and depth to the fragipan is about 18 inches. Included in mapping are a few small areas of Wellsboro very stony silt loam and a few small wet areas. Also included are a few small areas of Morris channery silt loam.

This Wellsboro soil is medium in natural fertility and low in content of organic matter. Erosion is a severe hazard if this soil is used intensively for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly close growing grasses and legumes are needed to control erosion. Artificial drainage is needed to remove excess water and improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas are used for hay and pasture and occasionally for cultivated crops. A few small areas left idle are reverting to brush and trees. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and slope. Capability subclass IVe.

WmB—Wellsboro very stony silt loam, 3 to 8 percent slopes. This gently sloping soil is on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. Loose stones cover about 3 to 10 percent of the surface. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface and the soil has no plow layer. Included in mapping are a few small areas of Wellsboro channery silt loam and a few small wet areas.

This Wellsboro soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability, and the surface stoniness. Capability subclass VIs.

WmD—Wellsboro very stony silt loam, 8 to 25 percent slopes. This sloping to moderately steep soil is on smooth or slightly concave uplands at the crests of hills and knolls and at the base of the steeper areas of broad, rolling mountains and intermountain basins. Loose stones cover about 3 to 10 percent of the surface. Runoff is medium to rapid, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but stones have not been removed from the surface and the soil has no plow layer. Included in mapping are a few small areas of Wellsboro channery silt loam and a few small wet areas.

This Wellsboro soil is medium in natural fertility and moderate in content of organic matter. Because of the surface stones, this soil is not suited to cultivated

crops. It is better suited to permanent pasture, woodland, or wildlife habitat. Applying adequate amounts of lime and fertilizer helps to maintain pasture yields.

Most areas of this soil are in woodland. A few small areas have been cleared and are used for permanent pasture. Most limitations for nonfarm use are related to the seasonal high water table, the slow permeability in the subsoil, slope, and the surface stoniness. Capability subclass VIs.

Wurtsboro Series

The Wurtsboro series consists of deep, moderately well drained, gently sloping to moderately steep soils. These soils are on the smooth, slightly concave uplands of broad, rolling mountaintops and intermountain basins. They formed in thick glacial till material derived from sandstone and conglomerate.

The top 2 inches in a representative profile is an organic layer of dark, partly decomposed leaf litter. The surface layer is 2 inches of black channery loam. The subsurface layer is 3 inches of grayish brown channery fine sandy loam. The subsoil to a depth of 60 inches is 17 inches of yellowish brown channery loam and channery sandy loam and 38 inches of firm, brittle, very dark grayish brown channery loam.

The fragipan in these soils restricts downward movement of roots and water. Permeability is slow, and available water capacity is moderate. The seasonal high water table is at a depth of 15 to 28 inches during wet periods.

Representative profile of Wurtsboro channery loam, 3 to 8 percent slopes, in Jenkins Township about a half mile southeast of Laflin Boro:

O1—2 inches to 0; dark partly decomposed hardwood leaf litter.

A1—0 to 2 inches; black (10YR 2/1) channery loam; weak fine and very fine granular structure; friable, nonsticky, nonplastic; many small and medium roots; 20 percent coarse fragments; extremely acid; abrupt smooth boundary.

A2—2 to 5 inches; grayish brown (10YR 5/2) channery fine sandy loam; weak fine subangular blocky structure parting to weak fine and very fine granular; friable, nonsticky, nonplastic; many small and medium roots; 25 percent coarse fragments; extremely acid; clear wavy boundary.

B21—5 to 17 inches; yellowish brown (10YR 5/4) channery loam; weak fine and medium angular blocky structure; friable, slightly sticky, slightly plastic; many small and medium roots; 15 percent coarse fragments; extremely acid; gradual wavy boundary.

B22—17 to 22 inches; yellowish brown (10YR 5/4) channery sandy loam; common medium prominent gray (N 5/0) and strong brown (7.5YR 5/8) mottles; weak medium and fine angular blocky structure; firm, slightly sticky, slightly plastic; common small roots; 20 percent coarse fragments; thin clay films in pores and bridging sand grains; extremely acid; clear wavy boundary.

Bx—22 to 60 inches; very dark grayish brown (10YR 3/2) channery loam, dark grayish brown (10YR 4/2) prism faces; many coarse prominent gray (N 5/0), strong brown (7.5YR 5/6), and dark brown (10YR 4/3) mottles; weak very coarse prismatic structure parting to weak very thick platy and weak coarse and medium subangular blocky; firm, brittle, slightly sticky, slightly plastic; few roots; 40 percent coarse fragments and less than 5 percent black coal fragments smaller than ½ inch in diameter; few thick clay films around pores and root channels; extremely acid.

Solum thickness ranges from 40 to 70 inches or more, and depth to bedrock is 5 feet or more. Depth to the fragipan ranges from 17 to 28 inches. The content of coarse fragments, by volume, ranges from 10 to 30 percent above the Bx horizon and from 15 to 60 percent in the Bx horizon. Distinct or prominent mottles with a low chroma are between a depth of 15 inches and the top of the Bx horizon, or they are within a depth of 20 inches. In unlimed areas reaction ranges from strongly acid to extremely acid throughout the profile. Color in the B2 horizon ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6). The fine earth texture in the B2 and Bx horizons ranges from loam to sandy loam. Color in the Bx horizon ranges from black (10YR 2/1) to dark grayish brown (2.5Y 4/2) and dark brown (10YR 4/3) with low and high chroma mottles and grayish prism faces.

Wurtsboro soils in Luzerne County have a lower chroma and value in the Bx horizon than is defined for the series because of weathered coal fragments in the soil, but this difference does not alter use, management, or behavior.

Wurtsboro, Lordstown, Dekalb, Volusia, and Chippewa soils formed in similar material. Wurtsboro soils are deep and moderately well drained, Lordstown and Dekalb soils are moderately deep and well drained, Volusia soils are deep and somewhat poorly drained, and Chippewa soils are deep and poorly drained and very poorly drained.

WrB—Wurtsboro channery loam, 3 to 8 percent slopes. This gently sloping soil is on mountaintops, in broad, smooth, slightly concave positions above more poorly drained soils. Runoff is slow, and the hazard of erosion is moderate.

In most areas this soil has the profile described as representative of the series, but in places it has a thicker plow layer. Included in mapping are a few small areas of Wurtsboro extremely stony loam and a few small areas of poorly drained and very poorly drained soils. Also included are a few small areas of severely eroded or gullied Wurtsboro soils.

This Wurtsboro soil is medium to low in natural fertility and low in content of organic matter. The seasonal high water table delays tillage early in spring and during wet periods. Artificial drainage is needed to remove excess water and improve use and management. Diversion terraces, contour stripcropping, minimum tillage, and a crop rotation that includes shallow rooted grasses and legumes are needed to control erosion.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas have been cleared of stones on the surface. Many areas near strip mine spoil are left idle. Some areas near the Susquehanna and Lackawanna Rivers are in urban use. A few small areas are used for cultivated crops and for hay. Most limitations for nonfarm use are related to the slow permeability, the content of coarse fragments, and the seasonal high water table. Capability subclass IIw.

WrC—Wurtsboro channery loam, 8 to 15 percent slopes. This sloping soil is in smooth, slightly concave positions at the crests of hills and knolls or at the base of steeper areas above more poorly drained soils on the sides of ridges and mountains. Runoff is medium, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described

as representative of the series, but the plow layer is thicker in some areas. Included in mapping are a few small areas of Wurtsboro extremely stony loam and a few small wet areas. Also included are a few small areas of severely eroded or gullied Wurtsboro soils.

This Wurtsboro soil is medium to low in natural fertility and low in content of organic matter. Erosion is a moderate hazard if this soil is used for cultivated crops. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes shallow rooted grasses and legumes are needed to control erosion. Artificial drainage helps to improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas have been cleared of stones on the surface. Many areas near strip mine spoil are left idle. Some areas near the Susquehanna and Lackawanna Rivers are in urban use. A few small areas are used for cultivated crops and hay. Most limitations for nonfarm use are related to slope, the slow permeability, and the seasonal high water table. Capability subclass IIIe.

WrD—Wurtsboro channery loam, 15 to 25 percent slopes. This moderately steep soil is on the smooth, slightly concave, narrow sides of hills or knolls or at the base of steep areas and above more poorly drained soils. Runoff is medium to rapid, and the hazard of erosion is moderate.

The profile of this soil is similar to the one described as representative of the series, but the plow layer is thicker in some areas and depth to the fragipan is about 18 inches. Included in mapping are a few small areas of Wurtsboro extremely stony loam and a few small wet areas. Also included are a few small areas of severely eroded or gullied Wurtsboro soils.

This Wurtsboro soil is medium to low in natural fertility and low in content of organic matter. Erosion is a severe hazard if this soil is used for cultivated crops. The seasonal high water table delays tillage early in spring and during wet periods. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly shallow rooted, close growing grasses and legumes are needed to control erosion. Artificial drainage helps to improve use and management.

This soil is suited to most shallow rooted crops commonly grown in the county. Most areas have been cleared of stones on the surface. Many areas near strip mine spoil are left idle. Some areas near the Susquehanna and Lackawanna Rivers are in urban use. A few small areas are used for permanent hay or pasture. Most limitations for nonfarm use are related to slope, the slow permeability in the subsoil, and the seasonal high water table. Capability subclass IVe.

WtB—Wurtsboro extremely stony loam, 3 to 8 percent slopes. This gently sloping soil is in broad, smooth, slightly concave positions above more poorly drained soils. The surface area is about 15 to 25 percent loose stones. Runoff is slow, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but the surface layer has not been cleared of large stones. Included in mapping are a few small areas of Wurtsboro channery loam and a few small areas of poorly drained or very poorly drained soils.

This Wurtsboro soil is medium to low in natural fertility and low in content of organic matter. Because of surface stoniness, this soil is not suited to cultivated crops or permanent pasture. It is better suited to woodland or wildlife habitat. Stones on the surface restrict the use of some woodland equipment.

Most areas of this soil are in woodland. Most limitations for nonfarm use are related to the slow permeability in the subsoil, the seasonal high water table, and the surface stoniness. Capability subclass VIIs.

WtD—Wurtsboro extremely stony loam, 8 to 25 percent slopes. This sloping to moderately steep soil is in smooth, slightly concave positions at the crests of hills and knolls and on long and narrow, irregularly shaped hillsides and valley sides at the foot slopes of steeper areas. The surface area is about 15 to 25 percent loose stones. Runoff is medium, and the hazard of erosion is slight.

The profile of this soil is similar to the one described as representative of the series, but the surface layer has not been cleared of large stones and boulders or disturbed by plowing. Included in mapping are a few small areas of Wurtsboro channery loam and a few small areas of poorly drained and very poorly drained soils.

This Wurtsboro soil is medium to low in natural fertility and low in content of organic matter. Because of surface stoniness, this soil is not suited to cultivated crops or permanent pasture. It is better suited to woodland or wildlife habitat. Stones on the surface restrict the use of some woodland equipment.

Most areas of this soil are in woodland. Most limitations for nonfarm use are related to slope, the slow permeability, the seasonal high water table, and the surface stoniness. Capability subclass VIIs.

Wyoming Series

The Wyoming series consists of deep, somewhat excessively drained, moderately steep to very steep soils. These soils are on the sides of kames, eskers, and moraines. They formed in thick glacial outwash sediments from the melting glacial ice mass.

The top 1 inch in a representative profile is a layer of black, partly decomposed organic material. The surface layer is 3 inches of brown gravelly loam. The upper 3 inches of the subsoil is dark reddish brown and yellowish red gravelly loam, and the lower 16 inches is brown gravelly heavy sandy loam and very gravelly sandy loam. The underlying material to a depth of 60 inches is reddish brown very gravelly loamy sand.

These soils have a deep root zone. Permeability is moderately rapid to rapid, and available water capacity is moderate to very low.

Representative profile of Wyoming gravelly loam, 15 to 25 percent slopes, in Buck Township about a quarter mile southwest of the intersection of the Luzerne, Lackawanna, and Monroe county lines:

O2—1 inch to 0; black (10YR 2/1) partly decomposed organic material.
A1—0 to 3 inches; brown (7.5YR 5/2) gravelly loam; weak fine granular structure; very friable, slightly sticky, nonplastic; many small and medium roots; 25 percent gravel; extremely acid; abrupt wavy boundary.
B21h—3 to 4 inches; dark reddish brown (5YR 3/3) gravelly loam; weak fine subangular blocky structure; very friable, slightly sticky, slightly plastic; many small and medium roots; 25 percent gravel; extremely acid; gradual wavy boundary.
B22ir—4 to 6 inches; yellowish red (5YR 5/6) gravelly loam; weak fine subangular blocky structure; very friable, slightly sticky, slightly plastic; many small and medium roots; 25 percent gravel; extremely acid; gradual wavy boundary.
B23—6 to 14 inches; brown (7.5YR 5/4) gravelly heavy sandy loam; weak fine subangular blocky structure; friable, slightly sticky, nonplastic; common small roots; 25 percent gravel; extremely acid; gradual wavy boundary.
B3—14 to 22 inches; brown (7.5YR 5/4) very gravelly sandy loam; weak fine subangular blocky structure; very friable, nonsticky, nonplastic; common small roots; 50 percent gravel; very strongly acid; gradual wavy boundary.
C—22 to 60 inches; reddish brown (5YR 4/4) very gravelly loamy sand with many white leached sand grains; single grained; loose, nonsticky, nonplastic; few small roots; 70 percent coarse fragments; very strongly acid.

Solum thickness ranges from 18 to 30 inches. Depth to bedrock is 10 feet or more. The content of coarse fragments of water-rounded gravel ranges from 40 to 75 percent in the B3 and C horizons. In unlimed areas reaction ranges from extremely acid to medium acid throughout the profile. Some pedons lack Bh and Bir horizons. The B2 and B3 horizons range from dark brown (10YR 4/3) to reddish brown (2.5YR 5/4). The fine earth texture of the B2 and B3 horizons is sandy loam or fine sandy loam. Some pedons have a B1 horizon. Color in the C horizon is similar to that in the B horizon. Texture of the fine earth fraction in the C horizon ranges from sandy loam to sand.

Wyoming, Chenango, Braceville, and Rexford soils and the Atherton variant formed in similar material. Wyoming soils are similar to Chenango soils, but are more than 50 percent fine and coarse sand between depths of 10 and 24 inches. They are better drained than the Atherton variant and Braceville and Rexford soils.

WyD—Wyoming gravelly loam, 15 to 25 percent slopes. This moderately steep soil is in broad, smooth or hilly, convex positions on the sides of glacial outwash moraines, kames, and eskers. Runoff is medium to rapid, and the hazard of erosion is moderate.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of a soil that has more silt and very fine sand in the subsoil. Also included, near Bear Creek, are areas of Wyoming soils where 3 to 10 percent of the surface is covered with gravel and cobblestones.

This Wyoming soil is low in natural fertility and low in content of organic matter. Because of the rapid permeability in the subsoil, nutrients from fertilizer leach through this soil rapidly. Erosion is a severe hazard if this soil is used for cultivated crops. Diversion terraces, stripcropping, minimum tillage, and a crop rotation that includes mostly grasses and legumes are needed to control erosion.

This soil is suited to most deep rooted, drought-tolerant crops commonly grown in the county, but it is better suited to permanent hay or pasture. Most areas are in woodland. Some areas are in permanent hay or pasture, and a few areas have been quarried for sand and gravel. Most limitations for nonfarm use are related to slope, the rapid permeability, the content of coarse fragments, and the possibility of ground contamination. Capability subclass IVe.

WyF—Wyoming gravelly loam, 25 to 60 percent slopes. This steep to very steep soil is in broad, smooth or complex, convex positions on the sides of glacial outwash moraines, kames, and eskers. Runoff is rapid, and the hazard of erosion is moderate.

Included with this soil in mapping are a few small areas of a soil that has more silt and very fine sand in the subsoil. Also included, near Bear Creek, are areas of Wyoming soils where 3 to 10 percent of the surface is covered with gravel and cobblestones.

This Wyoming soil is low in natural fertility and low in content of organic matter. Because of the steep to very steep slopes, this soil is not suited to cultivated crops. It is better suited to permanent pasture, woodland, or wildlife habitat.

Most areas of this soil are in woodland. A few areas left idle are reverting to brush and trees. A few areas have been quarried for sand and gravel. Most limitations for nonfarm use are related to slope, the rapid permeability, and the content of coarse fragments. Capability subclass VIIe.

Use and Management of the Soils

The following pages define general principles of management that apply to all soils used for farming in Luzerne County. They explain the capability classification and list estimated yields per acre of the principal crops under high level management. Also on the pages that follow is information on woodland, wildlife habitat, and engineering, and on selected uses of soils to be considered in town and country planning and in planning recreational facilities.

Crops and Pasture[2]

[2]Prepared in cooperation with ROBERT L. BOND, agronomist, Soil Conservation Service.

On the following pages the capability classification is explained. The capability subclass, which groups soils according to their suitability for crops, is briefly described, and yields are given for specified crops under a high level of management. The principal crops grown in the county are corn, wheat, oats, and hay. Some cabbage, tomatoes, and beans are grown for canning.

The descriptions of the mapping units in the section "Descriptions of the Soils" mention the need for artificial drainage and control of runoff and erosion.

Open field drains, surface main and lateral drains, subsurface drains, and diversions increase the suitability of soils for crops. Diversions, stripcropping (fig. 7), contour stripcropping, crop rotations, grass crops, and minimum tillage help in controlling erosion and reducing runoff.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for trees or engineering.

In the capability system, all kinds of soils are grouped at two levels: the capability class and the subclass. These levels are defined in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife habitat. (None in Luzerne County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial crop pro-

Figure 7.—**Stripcropping on rolling Meckesville, Leck Kill, and Kedron soils.**

duction and restrict their use to recreation or wildlife habitat or to esthetic purposes. (None in Luzerne County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion unless close growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife habitat, or recreation.

In this survey area the soils are classified at the class and subclass levels. The management needs for crops and pasture are specified in the mapping unit descriptions.

Estimated yields

Table 2 shows estimates of yields under high level management of the principal crops in Luzerne County. Only arable soils are listed. The estimates are average for a period of 5 years or more, not for just one season. It is expected that yields will increase 10 to 25 percent by 1985 as a result of development of new crop varieties and improved methods of production. Yields increased 2 percent per year in Pennsylvania during the 1960's.

For cultivated crops under high level management—

1. Surface and internal drainage provide optimum growing conditions where natural drainage is restricted.
2. Lime, phosphate, potash, nitrogen, and other elements are applied according to crop needs indicated by soil tests.
3. All crop residue is returned to the soil. If low-residue crops are grown, organic matter is supplied by growing cover crops and by applying manure or other organic material.
4. Seedbed preparation is limited to that preparation needed for crop production. Tillage is avoided when the soils are wet, and in spring it is delayed until planting time. If plowed in fall, fields are left rough in winter.
5. Weeds and insects are adequately controlled.
6. Crop variety, seed quality, and plant population are considered for a specified soil and location.
7. Erosion is kept within tolerable limits.
8. Fieldwork is generally timely.

For hay and pasture grasses under high level management—

1. Surface and internal drainage provide optimum growing conditions.
2. Lime and fertilizer are applied at seeding time according to crop needs and the needs indicated by soil tests, and they also are applied as topdressing as needed.
3. Stands are reseeded and reestablished regularly.
4. Grass-legume stands are of high quality, and crop variety is considered for a specified soil and location.
5. Haymaking is timely.
6. Grazing is deferred and rotated as needed.

Woodland[3]

Luzerne County originally had a dense cover of trees, but clearing for housing and farming and cutting for commercial purposes eliminated all virgin stands. Now the commercial woodland, which occupies 74 percent of the land area, consists of second and third growth stands.

The principal forest cover types and the proportionate extent of each, according to the Forest Service (*4*), are as follows:

	Percentage of total commercial woodland in the county
White pine	10.5
Eastern white pine makes up 50 percent or more of the stand. Yellow-poplar, northern red oak, and white oak are the main associates.	
Elm-ash-red maple	10.5
White ash, American elm, and red maple predominate. Associates are slippery elm, yellow birch, blackgum, sycamore, and hemlock.	
Maple-beech-birch	4.2
Sugar maple, beech, and yellow birch are component species. Associates are varying admixtures of basswood, red maple, hemlock, northern red oak, ash, white pine, black birch, and yellow-poplar.	
Aspen-birch	15.0
Quaking aspen, bigtooth aspen, and gray birch predominant in the mixture. Principal associates are pin cherry, red maple, yellow birch, white pine, ash, and sugar maple.	
Oak-hickory	53.8
White oak, red oak, and hickory predominate, although black oak is sometimes predominate. Principal associates are yellow-poplar, shagbark hickory, white ash, red maple, beech, and blackgum and an understory of flowering dogwood.	
Virginia pine-pitch pine	3.8
Virginia pine and pitch pine predominate. Principal associates are northern red oak, black oak, chestnut oak, scarlet oak, blackgum, and hickory.	
Other oak types	2.2

[3] By V. C. MILES, woodland conservationist, Soil Conservation Service.

TABLE 2—*Estimated yields of field crops, forage crops, and specialty crops*

[Prepared in cooperation with E. V. Chadwick, extention director, and A. T. Skala, associate extention director of Luzerne County. Ratings refer to yields under a high level of management. Absence of a figure or rating indicates that the crop is not commonly grown on the soil or is not suited to that soil]

Soils	Corn	Corn silage	Oats	Wheat	Cabbage	Potatoes	Hay		Pasture		Tomatoes	Suitability for orchards
							Alfalfa	Clover-grass	Bluegrass	Tall grass		
	Bu	*Tons*	*Bu*	*Bu*	*Tons*	*Bu*	*Tons*	*Tons*	*AUM*[1]	*AUM*[1]	*Tons*	
Alvira silt loam, 3 to 8 percent slopes	90	18	65	35		400	3.0	3.0	4.5	5.5		
Alvira very stony silt loam, 0 to 8 percent slopes									4.5			
Atherton silt loam, gray subsoil variant	70	14	60					3.0	4.5	5.5		
Basher soils	110	22	75	40	14	600	4.5	3.5	5.5	8.0	15	Good.
Bath channery silt loam, 3 to 8 percent slopes	105	21	75	45	12	500	4.0	3.5	5.5	7.5	14	Good.
Bath channery silt loam, 8 to 15 percent slopes	100	20	75	45	12	450	4.0	3.5	5.5	7.5	14	Good.
Bath channery silt loam, 15 to 25 percent slopes	95	19	70	40			3.5	3.0	4.5	6.5		
Bath very stony silt loam, 3 to 8 percent slopes									4.5			
Bath very stony silt loam, 8 to 25 percent slopes									3.5			
Braceville gravelly loam, 0 to 3 percent slopes	100	20	80	40	10	550	4.5	3.5	5.5	8.5	14	Good.
Braceville gravelly loam, 3 to 8 percent slopes	100	20	80	40	10	550	4.5	3.5	5.5	8.5	14	Good.
Braceville gravelly loam, 8 to 15 percent slopes	95	19	75	35	10	500	4.0	3.0	4.5	7.5	14	Good.
Buchanan channery loam, 3 to 8 percent slopes	95	19	70	35	8	400	3.5	3.0	5.0	6.5	10	Fair.
Chenango gravelly loam, 0 to 3 percent slopes	100	20	80	45	12	500	4.5	3.5	5.5	8.5	14	Good.
Chenango gravelly loam, 3 to 8 percent slopes	100	20	80	45	12	500	4.5	3.5	5.5	8.5	14	Good.
Chenango gravelly loam, 8 to 15 percent slopes	90	18	75	40	12	450	4.5	3.5	5.5	8.5	14	Good.
Chippewa silt loam, 0 to 3 percent slopes								2.5	4.0	5.0		
Chippewa silt loam, 3 to 8 percent slopes								2.5	4.0	5.0		
Holly silt loam	90	18	70					3.5	5.0	6.5		
Kedron channery silt loam, 3 to 8 percent slopes	100	20	70	40	12	450	3.5	3.0	5.0	7.0	14	Fair.
Kedron channery silt loam, 8 to 15 percent slopes	90	18	65	40	12	400	3.5	3.0	5.0	7.0	14	Fair.
Kedron very stony silt loam, 3 to 8 percent slopes									3.5			
Kedron very stony silt loam, 8 to 20 percent slopes									3.5			
Kedron channery silt loam, somewhat poorly drained, 0 to 8 percent slopes	80	16	65	35		400	3.0	3.0	4.5	5.5		
Kedron very stony silt loam, somewhat poorly drained, 0 to 8 percent slopes									3.5			
Lackawanna channery silt loam, 3 to 8 percent slopes	105	21	75	45	12	500	4.0	3.5	5.5	7.5	14	Good.
Lackawanna channery silt loam, 8 to 15 percent slopes	100	20	75	45	12	450	4.0	3.5	5.5	7.5	14	Good.
Lackawanna channery silt loam, 15 to 25 percent slopes	95	19	70	40			3.5	3.0	4.5	6.5		
Lackawanna very stony silt loam, 3 to 8 percent slopes									4.5			
Lackawanna very stony silt loam, 8 to 25 percent slopes									3.5			
Leck Kill channery silt loam, 3 to 8 percent slopes	115	23	75	45	12	500	4.5	3.5	5.5	8.5	14	Good.
Leck Kill channery silt loam, 8 to 15 percent slopes	110	22	70	40	12	450	4.0	3.0	5.0	8.0	14	Good.
Leck Kill channery silt loam, 15 to 25 percent slopes	100	20	60	35			4.0	2.5	4.5	7.5		
Linden soils	120	24	70	45	14	650	4.5	3.5	5.5	8.5	18	Good.
Mardin channery silt loam, 3 to 8 percent slopes	100	20	70	40	10	450	4.0	3.0	4.5	7.5	10	Fair.
Mardin channery silt loam, 8 to 15 percent slopes	90	18	65	40	10	400	4.0	3.0	4.5	7.5	10	Fair.
Mardin channery silt loam, 15 to 25 percent slopes	80	16	65	35			3.5	3.0	4.5	6.5		

TABLE 2.—*Estimated yields of field crops, forage crops, and specialty crops*—Continued

Soils	Corn	Corn silage	Oats	Wheat	Cabbage	Potatoes	Hay		Pasture		Tomatoes	Suitability for orchards
							Alfalfa	Clover-grass	Blue-grass	Tall grass		
	Bu	*Tons*	*Bu*	*Bu*	*Tons*	*Bu*	*Tons*	*Tons*	*AUM*[1]	*AUM*[1]	*Tons*	
Mardin very stony silt loam, 3 to 8 percent slopes									3.5			
Mardin very stony silt loam, 8 to 25 percent slopes									3.0			
Meckesville channery silt loam, 3 to 8 percent slopes	110	22	75	45	12	500	4.0	3.0	4.5	7.5	14	Good.
Meckesville channery silt loam, 8 to 15 percent slopes	100	20	70	40	12	450	4.0	3.0	4.5	7.5	14	Good.
Meckesville channery silt loam, 15 to 25 percent slopes	90	18	65	35			3.5	2.5	4.0	6.5		
Meckesville very stony silt loam, 3 to 8 percent slopes									4.0			
Meckesville very stony silt loam, 8 to 25 percent slopes									3.5			
Morris channery silt loam, 0 to 8 percent slopes	90	18	65	35	8	400	3.0	3.0	4.5	5.5	10	Fair.
Morris channery silt loam, 8 to 15 percent slopes	80	16	60	30	8	350	3.0	3.0	4.5	5.5	10	Fair.
Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes	90	18	70	45	10	400	3.5	3.0	4.5	6.5	10	Fair.
Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes	85	17	70	40	10	350	3.5	3.0	4.5	6.5	10	Fair.
Oquaga and Lordstown channery silt loams, 15 to 25 percent slopes	80	16	65	35			3.0	3.0	4.5	5.5		
Pocono gravelly sandy loam, 3 to 8 percent slopes	90	18	65	35	8	400	3.5	3.0	5.0	7.0	8	Poor.
Pocono gravelly sandy loam, 8 to 15 percent slopes	80	17	60	35	8	350	3.0	2.5	5.0	7.0	8	Poor.
Pope soils	135	27	80	50	15	650	5.0	3.5	5.5	9.5	20	Good.
Rexford loam, 0 to 3 percent slopes	90	18	65	35		450	3.0	3.0	4.5	6.0		
Rexford loam, 3 to 8 percent slopes	90	18	65	35		450	3.0	3.0	4.5	6.0		
Shelmadine silt loam, 0 to 5 percent slopes	80	16	55					2.5		5.0		
Volusia channery silt loam, 0 to 8 percent slopes	80	16	65	35	10	400	3.0	3.0	4.5	5.5	10	Fair.
Volusia channery silt loam, 8 to 15 percent slopes	70	14	60	30	10	350	3.0	3.0	4.5	5.5	10	Fair.
Wayland silt loam	90	18						3.5	5.5	6.5		
Weikert and Klinesville channery silt loams, 3 to 8 percent slopes	50	10	55	35			2.5	2.0	3.0	5.0		
Weikert and Klinesville channery silt loams, 8 to 15 percent slopes	45	9	50	30			2.0	2.0	3.0	4.0		
Weikert and Klinesville channery silt loams, 15 to 25 percent slopes									2.0			
Wellsboro channery silt loam, 3 to 8 percent slopes	95	19	65	40	12	450	4.0	3.0	4.5	7.5	12	Fair.
Wellsboro channery silt loam, 8 to 15 percent slopes	90	18	65	40	12	400	4.0	3.0	4.5	7.5	12	Fair.
Wellsboro channery silt loam, 15 to 25 percent slopes	80	16	60	35			3.5	3.0	4.5	6.5		
Wellsboro very stony silt loam, 3 to 8 percent slopes									3.5			
Wellsboro very stony silt loam, 8 to 25 percent slopes									3.0			
Wurtsboro channery loam, 3 to 8 percent slopes	95	19	65	35	10	450	4.0	3.0	4.5	7.5	14	Fair.
Wurtsboro channery loam, 8 to 15 percent slopes	85	17	60	35	10	400	4.0	3.0	4.5	7.5	14	Fair.
Wurtsboro channery loam, 15 to 25 percent slopes	75	15	60	30			3.5	3.0	4.5	6.5		
Wyoming gravelly loam, 15 to 25 percent slopes			50	30			3.0	2.0	3.0	5.5		
Wyoming gravelly loam, 25 to 60 percent slopes									2.0			

[1]Animal unit month is the number of months 1 acre will provide grazing for one animal without injury to the pasture. One animal unit is defined as one cow, steer, or horse; five pigs; or seven sheep or goats.

At the time of this survey, farmers owned 11.7 percent of the commercial forest land; other private sources, 79.4 percent; forest industry, 0.3 percent; Pennsylvania Game Commission, 8.3 percent; and the Pennsylvania Department of Environmental Resources, Bureau of Forestry, 0.3 percent.

In 1973, sawtimber made up about 25 percent of the acreage in commercial forests; poletimber, 40 percent; and seedlings and saplings, 32 percent. The remaining 3 percent was classified nonstocked (*4*).

In general the soils in the county can support a good growth of yellow-poplar, ash, red oak, and sugar maple (fig. 8). Trees grow slowly on the shallow soils (fig. 9) and on the deep, very poorly drained soils.

A landowner can encourage the growth of more desirable trees by using good woodland management. The soils and the climate are favorable, and local technicians can provide help in planning a program of woodland improvement. The effort a landowner is willing to make toward improving his woodland probably depends on general economic conditions.

The return from excellent, very good, or good growing sites generally justifies the expenditure of money for management purposes. The potential should be considered. The species and the proportion of poor quality stems on such sites can prohibit further management investment. Converting these sites to potential capacity may not be economically justifiable.

The *fair* growing sites are the most difficult to appraise. A thorough appraisal of species and site quality is essential. The market possibility also should be investigated. A proper analysis of all of these interrelated factors is essential in determining the intensity of management.

The return from poor growing sites may not economically justify management for the production of wood crops. Nevertheless, woodland is one of the most practical land uses. Because of unfavorable characteristics, soils that are poor woodland sites do not return a profit in cropland or grassland.

Management problems and hazards, species suitability, and site quality for producing timber are shown in table 3 for all soils for which data are available.

Ratings in the column *Erosion hazard* indicate the amount or intensity of management required to reduce or control erosion on the different soils. A rating of *slight* indicates that the risk of erosion is low when wood products are harvested, and that few, if any, practices are needed to control erosion. A rating of *moderate* indicates that erosion control is needed on skid and logging roads immediately after wood products are harvested. A rating of *severe* means that erosion, especially gullying, is a severe hazard when wood products are harvested. Harvesting and other operations should be done across the slope as much as possible. Skid trails and logging roads should be laid out on as low a grade as possible, and water disposal systems should be carefully maintained during logging. Erosion control is needed on logging roads and skid trails immediately after logging.

Ratings in the column *Equipment limitations* are based on the characteristics of the soils and topographic features that restrict or prohibit the use of equipment for harvesting trees or planting seedlings. Steepness of slope, stoniness, and wetness are the principal

Figure 8.—Good stand of mixed hardwoods on Wurtsboro extremely stony loam, 3 to 8 percent slopes.

Figure 9.—Slow-growing stand of mixed oaks on Arnot-Rock outcrop complex, 0 to 8 percent slopes.

soil limitations that restrict the use of equipment. The rating is *slight* if there are few limitations. It is *moderate* if the soil is stony and bouldery, is moderately steep, or is wet during part of the year. The rating is *severe* if steepness, stoniness, or prolonged wetness severely limits the use of equipment. If the rating is severe, track-type equipment is best for general use. Winches or similar special equipment is needed for some kinds of work.

Seedling mortality refers to the loss of naturally occurring or planted tree seedlings resulting from unfavorable characteristics of the soils. The rating is *slight* if no more than 25 percent of the planted seedlings are likely to die and satisfactory restocking from the initial planting can be expected. Adequate restocking ordinarily results from natural regeneration. A rating of *moderate* indicates that between 25 and 50 percent of planted seedlings are likely to die and some replanting is ordinarily needed. Natural regeneration cannot always be relied upon for adequate and early restocking. A rating of *severe* indicates that more than 50 percent of planted seedlings are likely to die and special preparation of the seedbed, superior planting techniques, and considerable replanting are needed for adequate and immediate restocking. Restocking cannot be expected to result from natural regeneration.

Plant competition refers to the rate at which brush, grass, and undesirable trees are likely to invade. Plant competition is *slight* if unwanted plants do not prevent adequate natural regeneration and early growth or interfere with adequate development of planted seedlings. It is *moderate* if competing plants delay both natural or artificial regeneration, but do not prevent the natural development of a fully stocked normal stand. Competition is *severe* if adequate natural or artificial regeneration can be obtained only by intensive site preparation and maintenance, including weeding.

Windthrow hazard is an evaluation of the factors that relate to the development of tree roots and the likelihood that trees will be uprooted by wind. A rating of *slight* indicates that normally no trees are uprooted by the wind. A rating of *moderate* indicates that some trees are expected to be uprooted during periods of excessive soil wetness and high wind. A rating of *severe* indicates that many trees are expected to be uprooted during periods of soil wetness and moderate or high winds.

The trees most suitable for planting or managing in existing stands are listed in the columns *Species suitability*. In planning the development of an existing woodland, it is advisable to review this list. The objectives of the landowner determine the species to be favored when stands are to be established. The trees listed in the "for planting or seeding" column are recommended for these particular soils.

Site quality indicates the general ability of soils to produce timber. The site rating applies to the first species listed, but all species listed are commonly grown

TABLE 3.—
[Only the soils for which data

Soil series and map symbols	Management problems				
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Windthrow hazard
Alvira: AlB, AnB	Slight	Moderate	Moderate	Severe for conifers, moderate for hardwoods.	Slight
Arnot:					
ArB, ArD Rock outcrop part not rated.	Slight	Moderate	Moderate	Moderate for conifers, slight for hardwoods.	Moderate
ASF	Moderate	Severe	Severe	Moderate for conifers, slight for hardwoods.	Moderate
Atherton variant: At	Slight	Severe	Severe	Severe for conifers and hardwoods.	Severe
Basher: Bf	Slight	Slight	Slight	Severe for conifers, moderate for hardwoods.	Slight
Bath:					
BkB, BkC, BnB	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
BkD, BnD	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
Braceville: BrA, BrB, BrC	Slight	Slight	Slight	Severe for conifers, moderate for hardwoods.	Slight
Buchanan:					
BuB	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
BxB	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
BxD	Moderate	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
Chenango: ChA, ChB, ChC	Slight	Slight	Slight	Severe for conifers, moderate for hardwoods.	Slight
Chippewa: ClA, ClB, CnB	Slight	Severe	Severe	Severe for conifers, moderate for hardwoods.	Severe
Dekalb:					
DdB, DdD	Slight	Moderate	Moderate	Slight for conifers and hardwoods.	Slight
DEF	Moderate	Severe	Severe	Slight for conifers and hardwoods.	Slight
Holly: Ho	Slight	Severe	Severe	Severe for conifers and hardwoods.	Moderate
Kedron:					
KdB, KdC, KeB	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
KeC	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight

Woodland

are available are listed]

Species suitability		Site quality	
To favor in existing stands	For planting or seeding	Site rating	Species
White ash, northern red oak, sugar maple, red maple, yellow-poplar,	Yellow-poplar, European larch, eastern white pine, white spruce, Norway spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, red maple, eastern white pine.	Virginia pine, red pine, eastern white pine, European larch, Norway spruce.	Fair	Northern red oak and red maple.
Northern red oak, red maple, eastern white pine.	Virginia pine, red pine, eastern white pine, European larch, Norway spruce.	Fair	Northern red oak and red maple.
Northern red oak, red maple, American sycamore.	Eastern white pine and white spruce	Excellent for pin oak, poor for rest.	Red maple.
Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black walnut, black cherry.	Yellow-poplar, black walnut, European larch, Norway spruce, eastern white pine, black cherry.	Excellent	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry.
Northern red oak, white ash, sugar maple, red maple, yellow-poplar.	Yellow-poplar, European larch, red pine, Norway spruce, eastern white pine.	Fair	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, red maple, yellow-poplar.	Yellow-poplar, European larch, red pine, Norway spruce, eastern white pine.	Fair	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, red maple, black cherry, yellow-poplar.	Yellow-poplar, European larch, red pine, Norway spruce, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, yellow-poplar.	Yellow-poplar, European larch, eastern white pine, Norway spruce, white spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, yellow-poplar.	Yellow-poplar, European larch, eastern white pine, Norway spruce, white spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, yellow-poplar.	Yellow-poplar, European larch, eastern white pine, Norway spruce, white spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, red maple, black cherry, yellow-poplar.	Yellow-poplar, European larch, red pine, Norway spruce, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry.
Red maple	Eastern white pine, white spruce	Poor	Red maple.
Northern red oak, Virginia pine, eastern white pine, red maple.	Eastern white pine, red pine, Virginia pine, pitch pine.	Poor	Northern red oak, red maple, Virginia pine.
Northern red oak, Virginia pine, eastern white pine, red maple.	Eastern white pine, red pine, Virginia pine, pitch pine.	Poor	Northern red oak, red maple, Virginia pine.
Northern red oak, red maple, American sycamore.	Eastern white pine, white spruce.	Excellent for pin oak, poor for rest.	Red maple.
Northern red oak, white ash, sugar maple, red maple, yellow-poplar.	Yellow-poplar, European larch, eastern white pine, Norway spruce, white spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.
Northern red oak, white ash, sugar maple, red maple, yellow-poplar.	Yellow-poplar, European larch, eastern white pine, Norway spruce, white spruce.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar.

TABLE 3.—

Soil series and map symbols	Management problems				
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Windthrow hazard
Kedron—Continued KwB, KxB	Slight	Moderate	Moderate	Severe for conifers and hardwoods.	Slight
Klinesville: Mapped only with Weikert soils.					
Lackawanna: LaB, LaC, LcB	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
LaD, LcD	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
LEF For Bath part of LEF, see Bath series.	Moderate	Severe	Slight	Moderate for conifers, slight for hardwoods.	Slight
Leck Kill: LkB, LkC	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
LkD	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
Linden: Ln	Slight	Slight	Slight	Severe for conifers, moderate for hardwoods.	Slight
Lordstown. Mapped only with Oquaga soils.					
Mardin: MaB, MaC, McB	Slight	Slight	Slight	Slight for conifers and hardwoods.	Slight
MaD, McD	Slight	Moderate	Slight	Slight for conifers and hardwoods.	Slight
Meckesville: MeB, MeC, MfB	Slight	Slight	Slight	Severe for conifers, moderate for hardwoods.	Slight
MeD, MfD	Slight	Moderate	Slight	Severe for conifers, moderate for hardwoods.	Slight
Morris: MoB, MoC, MsB, MsC	Slight	Moderate	Moderate	Severe for conifers and hardwoods.	Moderate
Oquaga: OlB, OlC	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
OlD, OpB, OpD	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
OXF	Moderate	Severe	Slight	Moderate for conifers, slight for hardwoods.	Slight
Pocono: PoB, PoC	Slight	Slight	Severe	Moderate for conifers, slight for hardwoods.	Slight
PpB, PpD	Slight	Moderate	Severe	Moderate for conifers, slight for hardwoods.	Slight

Woodland—Continued

Species suitability		Site quality	
To favor in existing stands	For planting or seeding	Site rating	Species
Northern red oak, white ash, sugar maple, red maple, black cherry, yellow-poplar,	Yellow-poplar, European larch, Norway spruce, eastern white pine, white spruce, black cherry.	Good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, Virginia pine, eastern white pine, red maple.	Virginia pine, eastern white pine, European larch, Norway spruce, red pine.	Good	Northern red oak, Virginia pine, red maple, eastern white pine.
Northern red oak, Virginia pine, eastern white pine, red maple.	Virginia pine, eastern white pine, European larch, Norway spruce, red pine.	Good	Northern red oak, Virginia pine, red maple, eastern white pine.
Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black walnut, black cherry.	Yellow-poplar, black walnut, European larch, Norway spruce, eastern white pine, black cherry.	Excellent	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Fair	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Fair	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, red maple, black cherry, yellow-poplar,	Yellow-poplar, European larch, red pine, Norway spruce, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry.
Northern red oak, white ash, sugar maple, red maple, black cherry, yellow-poplar.	Yellow-poplar, European larch, red pine, Norway spruce, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry
Black oak, chestnut oak, pitch pine	Pitch pine and Virginia pine	Poor	Black oak, chestnut oak, pitch pine.
Black oak, chestnut oak, pitch pine	Pitch pine and Virginia pine	poor	Black oak, chestnut oak, pitch pine.

TABLE 3.—

Soil series and map symbols	Management problems				
	Erosion hazard	Equipment limitations	Seedling mortality	Plant competition	Windthrow hazard
Pope: Ps	Slight	Slight	Slight	Severe for conifers, moderate for hardwoods.	Slight
Rexford: RdA, RdB	Slight	Moderate	Moderate	Severe for conifers, moderate for hardwoods.	Moderate
Shelmadine: ShA, SkB	Slight	Severe	Severe	Moderate for conifers and hardwoods.	Severe
Volusia: VoB, VoC, VrB, VrC	Slight	Moderate	Moderate	Severe for conifers, moderate for hardwoods.	Moderate
Wayland: Wa	Slight	Severe	Severe	Severe for conifers and hardwoods.	Moderate
Weikert:					
WeB, WeC	Slight	Slight	Severe	Slight for conifers and hardwoods.	Slight
WeD	Slight	Moderate	Severe	Slight for conifers and hardwoods.	Slight
Wellsboro:					
WlB, WlC, WmB	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
WlD, WmD	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
Wurtsboro:					
WrB, WrC	Slight	Slight	Slight	Moderate for conifers, slight for hardwoods.	Slight
WrD, WtB, WtD	Slight	Moderate	Slight	Moderate for conifers, slight for hardwoods.	Slight
Wyoming:					
WyD	Slight	Moderate	Severe	Moderate for conifers, slight for hardwoods.	Slight
WyF	Moderate	Severe	Severe	Moderate for conifers, slight for hardwoods.	Slight

on the specified soils. Ratings are based on sample plots within the county and in adjacent counties. Other soils in the county that have characteristics similar to those of the soils studied were assumed to have about the same rating.

Yield information of oak, under *Site rating*, is based on data by G. L. Schnur (*6*). Ratings are based on the site index, or the average height attained by the dominant and codominant trees at 50 years of age. The site index can be used to determine the volume of timber that normal stands will produce at different ages. A site index of 85 or better is rated *excellent*, and the expected yield at age 50 is 13,750 or more board feet per acre (published data for oak do not go beyond site index 80, International rule). A site index of 75 to 84 is rated *very good*, and the expected yield at age 50 is about 13,750 board feet per acre. A site index of 65 to 74 is rated *good*, and the expected yield at age 50 is about 9,750 board feet per acre. A site index of 55 to 64 is rated *fair*, and the expected yield at age 50 is about 6,300 board feet per acre. A site index of less than 54 is rated *poor*, and the expected yield at age 50 is less than 3,250 board feet per acre.

Yield information for yellow-poplar is based on data from E. F. McCarthy (*5*), Central States Experiment Station. A site index of 95 or better is rated *excellent*, and the expected yield at age 50 is 32,150 board feet per acre. A site index of 85 to 95 is rated *very good*, and the expected yield at age 50 is about 24,400 board feet per acre. A site index of 75 to 85 is rated *good*, and the expected yield is 17,620 board feet per acre. A site index of 65 to 75 is rated *fair*, and the expected yield is 11,400 board feet per acre. A site index of 55 to 65 is

Woodland—Continued

Species suitability		Site quality	
To favor in existing stands	For planting or seeding	Site rating	Species
Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black walnut, black cherry.	Yellow-poplar, black walnut, European larch, Norway spruce, eastern white pine, black cherry.	Excellent	Northern red oak, white ash, sugar maple, red maple, yellow-poplar, black cherry, black walnut.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, white spruce, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, red maple, eastern white pine.	Eastern white pine, European larch, Norway spruce.	Good	Northern red oak, white ash, sugar maple, red maple, eastern white pine.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, white spruce, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Red maple and white ash		Excellent for pin oak, poor for rest.	Red maple and white ash.
Northern red oak, chestnut oak, eastern white pine, Virginia pine.	Eastern white pine, red pine, Virginia pine, pitch pine.	Fair	Northern red oak, chestnut oak, Virginia pine, eastern white pine.
Northern red oak, chestnut oak, eastern white pine, Virginia pine.	Eastern white pine, red pine, Virginia pine, pitch pine.	Fair	Northern red oak, chestnut oak, Virginia pine, eastern white pine.
Northern red oak, white ash, sugar maple, black cherry, eastern white pine.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, black cherry, eastern white pine.
Northern red oak, white ash, sugar maple, black cherry, eastern white pine.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Very good	Northern red oak, white ash, sugar maple, black cherry, eastern white pine.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak, white ash, sugar maple, black cherry.	European larch, Norway spruce, red pine, eastern white pine, black cherry.	Good	Northern red oak, white ash, sugar maple, black cherry.
Northern red oak and red maple	Eastern white pine, red pine, Virginia pine, pitch pine.	Fair	Northern red oak and red maple.
Northern red oak and red maple	Eastern white pine, red pine, Virginia pine, pitch pine.	Fair	Northern red oak and red maple.

rated *poor,* and the expected yield is 5,600 board feet per acre.

The site index for other trees, such as red maple, white pine, sugar maple, ash, and black cherry, varies somewhat, but the better sites have taller trees of the same species at age 50. More information on site index for other tree species can be obtained from the Soil Conservation Service and the Pennsylvania Department of Environmental Resources, Bureau of Forestry.

Wildlife[4]

Many species of wildlife, fish, and songbirds are found throughout Luzerne County. The soils, topography, and patterns of land use are favorable for increasing the kinds and numbers of all species.

All land is capable of producing some kind of wildlife, generally several game and nongame species. In planning land use, the soils that are most suitable for crops and have the highest economic value are generally not considered for wildlife. Soils that provide wildlife habitat are generally severely limited and unsuitable for cultivation.

The kinds and abundance of wildlife depend to a large extent on the type of habitat available. Species of wildlife inhabit areas where their habitat requirements are provided by the vegetation. The vegetation in turn depends to a great extent upon the soil. If natural conditions of an area are altered by drainage, cultivation, or other practices used in managing farmland or woodland, the kinds and patterns of vegetation

[4]Prepared in cooperation with CLAYTON L. HEINEY, wildlife biologist, Soil Conservation Service.

change and in turn change the kinds and numbers of wildlife.

The soils in Luzerne County can be used for development of suitable wildlife habitat in woodlands, parks, hunting preserves, and refuges. In addition, the streams, lakes, and reservoirs have potential for greater use.

Kinds of wildlife[5]

The kinds of wildlife common in Luzerne County are described in the following paragraphs. Descriptions of the soil associations referred to can be found in the section "General Soil Map." The location of each soil association is shown on the general soil map at the back of this survey.

The white-tailed deer is the most abundant large game animal in the county. Deer are considered a forest species, but they do not thrive in a mature forest. They prefer a combination of brush or young trees, a few mature trees, and small open areas. Most areas of the county have this combination of characteristics, so white-tailed deer are generally well distributed. Throughout the county widespread timber cutting by the mining industry has inadvertantly created favorable food and cover for white-tailed deer. The concentration of deer is less in the populated areas of association 4, near Wilkes-Barre and neighboring communities.

The black bear is a common large game animal in Luzerne County. The greatest concentration of bear is in the northwest corner of the county, on soils of association 1, and in the east and southeast, on soils of associations 1 and 4. The somewhat poorly drained to very poorly drained soils in these associations provide favorable habitat for the black bear. These areas are also sparsely populated.

The wild turkey is an abundant large game bird in the county. Turkeys are most common on the soils of association 2 and in the forested areas of associations 1, 5, and 6. Turkeys prefer mature forests that produce mast.

Cottontail rabbits are plentiful in the county and are concentrated in the farming areas of associations 1, 3, 4, 6, and 7. They prefer brushy areas that are interspersed with cropland and grassland. Farms that are reverting to brushland are a good habitat for the cottontail rabbit.

The snowshoe hare, a close relative to the cottontail rabbit, is abundant in the more forested areas of the county. They are concentrated in the northwest corner of the county, on the soils of association 1, and in the east and southeast parts of the county, on the soils of associations 1 and 4.

The gray squirrel prefers woodlots and forested areas that are interspersed with areas of cropland. Squirrels are distributed throughout the county, but they are most concentrated in woodlots near the farming areas of associations 1, 4, 6, and 7. They are also concentrated in the forested areas on the foot slopes of associations 2 and 5.

[5]Prepared in consultation with JOHN A. BOOTH, land manager assistant, Pennsylvania Game Commission.

Pheasants are plentiful in the farming areas of associations 1, 4, 6, and 7. Pheasants prefer grain crops for food and hayfields and field borders for cover and nesting.

Ruffed grouse are plentiful throughout the county. They are most abundant in areas where farms are reverting to brushland and in the densely timbered woodland of associations 1, 4, 6, and 7. They are also abundant on the abandoned strip mines of association 3. Ruffed grouse prefer brushy stands of young trees, preferably aspen.

Woodcock are plentiful throughout the county. They are most abundant in areas of the sandier and wetter soils of association 4.

The beaver, the muskrat, and the racoon are the principal fur-bearing animals in the county. Beaver are concentrated in the wetter areas along streams in associations 1, 4, and 6. They prefer wooded areas of aspen and other soft woods adjacent to streams. Muskrats prefer marshy areas along streams and farm ponds. Raccoons prefer nearly any area that is accessible to streams or water.

Waterfowl are mainly black ducks, mallards, wood ducks, and some Canadian geese. Although Luzerne County is not considered a major flyway for these migratory birds, many species of ducks and geese stop to rest and feed on the many lakes and ponds in the county. Most of these lakes and ponds are in soil associations 1, 4, and 6. The many beaver dams in these associations also provide suitable stopping places for these migratory birds.

The woodchuck is a common nongame animal throughout the county. It is most common in the farming areas of associations 1, 4, 6, and 7. Woodchucks prefer open areas where grasses and legumes are grown.

Elements of wildlife habitat

Soil suitability is one of the important factors necessary for the production of desired populations of wildlife. Present land use and existing wildlife populations also are important, but are not considered in the soil survey. Soil interpretations should be used along with other information in a total study of resource suitability of an area for the production of wildlife.

Every species of wildlife requires certain types of soil, vegetation, and water for food and cover. Proper manipulation of soil, water, and plants to produce suitable habitat is the most effective means of maintaining and improving wildlife populations. Through knowledge of the properties of soils, it is possible to predict their suitability for the production of habitat elements essential for wildlife.

In table 4, the soils of Luzerne County are rated according to their suitability for the production of essential elements of wildlife habitat and types of habitat. The ratings are based on a modification of the system proposed by Allan and others *(1)*. Each rating reflects only the characteristics of the individual, unmodified soil. The columns in table 4 are described in the following paragraphs.

Grain and seed crops are domestic grain and seed-

producing annual plants, such as corn, wheat, and millet.

Grasses and legumes are domestic perennial grasses and herbaceous legumes, such as timothy, alfalfa, and reed canarygrass.

Wild herbaceous plants are wild grasses and weeds, such as goldenrod and pokeweed.

Hardwood trees are deciduous trees, shrubs, and vines, such as oaks, dogwoods, grapes, and briars.

Coniferous plants are cone-bearing trees and shrubs, such as pines, cedars, and yews.

Wetland plants are wild herbaceous plants on moist to wet sites, exclusive of submerged and floating aquatic plnts. Examples are smartweeds, bulrushes, reed canarygrass, and cattails.

Shallow water areas are no more than 5 feet deep. Such areas are natural or are created by low dikes, level ditches, and water control devices on marshy streams.

Openland wildlife require croplands, pastures, meadows, and areas overgrown with grasses, herbs, vines, or shrubby plants. Such areas provide habitat for quail, pheasants, doves, woodcock, cottontail rabbits, meadowlarks, killdeer, and field sparrows.

Woodland wildlife require areas of either hardwood or coniferous trees and shrubs or combinations of both. Such areas provide habitat for grouse, turkeys, deer, squirrels, wood thrushes, warblers, and vireos.

Wetland wildlife require marshes, swamps, and open water areas. Such areas provide habitat for ducks, geese, rails, snipe, muskrats, and beaver.

The ratings in table 4 indicate potential suitability of the soil for the production of various habitat elements and types of habitat. A rating of *good* means that the habitat generally is easily created, improved, or maintained. There are a few soil limitations in management, and satisfactory results can be expected.

A rating of *fair* means that habitat generally can be created, improved, or maintained, but moderate soil limitations affect management. Moderate intensity of management and frequent attention may be required for satisfactory results.

A rating of *poor* means that habitat generally can be created, improved, or maintained but severe soil limitations affect management and may make it difficult and expensive to maintain the habitat. Results are questionable.

A rating of *very poor* means that restrictions on the use of the soil for the element of wildlife habitat or type of wildlife are very severe. Under prevailing soil conditions, it is impractical to create, improve, or maintain habitat. Unsatisfactory results are probable.

Not considered in table 4 are changes in land use that may modify the local environment and thus alter the species of wildlife that inhabit the area.

Town and Country Planning

This part of the soil survey provides information on the properties of soils and their effect on selected uses of soils or town and country planning. It will help community planners, developers, and individual landowners to determine the most suitable use for a particular area. Other useful information can be found on the soil map and in other parts of the survey, particularly the sections "Descriptions of the Soils" and "Engineering." Although the soil map and tables serve as a guide and can eliminate some sites from further consideration, they do not supplant direct detailed onsite investigations when a development is being planned. Not considered in rating the soils are location in relation to established business centers or transportation lines and other economic factors that are important in determining the ultimate use of an area.

Soil limitations in table 5 are indicated by the ratings *slight, moderate,* and *severe. Slight* means that soil properties are generally favorable for the rated use, or in other words, limitations are minor and are easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* indicates that soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Following are explanations of the columns in table 5.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. It is assumed that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope. If the floor needs to be leveled, depth to and condition of bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified Soil Classification, and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Dwellings with basements, as rated in table 5, are for homes or other buildings of three stories or less that require no more than 8-foot excavation for basements. Buildings having foundation loads in excess of those equal to three-story dwellings and requiring more than an 8-foot excavation for basements are excluded from the ratings. Considered in rating the soils are

TABLE 4.—

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Alvira:				
AlB	Fair	Fair	Good	Good
AnB	Very poor	Poor	Good	Good
Arnot: ArB, ArD, ASF. Rock outcrop part too variable to rate.	Very poor	Very poor	Poor	Very poor
Atherton variant: At	Very poor	Poor	Poor	Poor
Basher: Bf	Good	Good	Good	Good
Bath:				
BkB	Fair	Good	Good	Good
BkC	Fair	Good	Good	Good
BkD	Poor	Fair	Good	Good
BnB	Very poor	Poor	Good	Good
BnD	Very poor	Poor	Good	Good
Braceville:				
BrA	Fair	Good	Good	Good
BrB	Fair	Good	Good	Good
BrC	Fair	Good	Good	Good
Buchanan:				
BuB	Fair	Good	Good	Good
BxB	Very poor	Very poor	Good	Good
BxD	Very poor	Very poor	Good	Good
Chenango:				
ChA, ChB	Poor	Fair	Fair	Poor
ChC	Poor	Fair	Fair	Poor
Chippewa:				
ClA	Very poor	Poor	Poor	Poor
ClB, CnB	Very poor	Poor	Poor	Poor
Dekalb:				
DdB	Very poor	Very poor	Fair	Poor
DdD, DEF	Very poor	Very poor	Fair	Poor
Holly: Ho	Poor	Fair	Fair	Fair
Kedron:				
KdB, KwB	Fair	Good	Good	Good
KdC	Fair	Good	Good	Good
KeB, KeC	Very poor	Poor	Good	Good
KxB	Very poor	Poor	Good	Good
Lackawanna:				
LaB	Fair	Good	Good	Good
LaC	Fair	Good	Good	Good
LaD	Poor	Fair	Good	Good
LcB	Very poor	Poor	Good	Good
LcD, LEF	Very poor	Poor	Good	Good
Leck Kill:				
LkB	Good	Good	Good	Good
LkC	Fair	Good	Good	Good
LkD	Poor	Fair	Good	Good
Linden: Ln	Good	Good	Good	Good
Mardin:				
MaB	Fair	Good	Good	Good
MaC	Fair	Good	Good	Good
MaD	Poor	Fair	Good	Good
McB	Very poor	Poor	Good	Good
McD	Very poor	Poor	Good	Good

Wildlife habitat

Potential for habitat elements			Potential as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Good	Poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Very poor	Poor	Very poor	Very poor	Very poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Poor	Fair	Very poor.
Good	Very poor	Very poor	Poor	Fair	Very poor.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Poor	Very poor	Very poor	Fair	Poor	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Poor	Fair	Very poor	Poor	Poor	Poor.
Poor	Poor	Very poor	Poor	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.

TABLE 4.—

Soil series and map symbols	Potential for habitat elements			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees
Meckesville:				
MeB	Fair	Good	Good	Good
MeC	Fair	Good	Good	Good
MeD	Poor	Fair	Good	Good
MfB	Very poor	Poor	Good	Good
MfD	Very poor	Poor	Good	Good
Morris:				
MoB	Fair	Good	Good	Good
MoC	Fair	Good	Good	Good
MsB	Very poor	Poor	Good	Good
MsC	Very poor	Poor	Good	Good
Oquaga:				
OlB	Poor	Fair	Fair	Fair
OlC, OlD	Poor	Fair	Fair	Fair
OpB	Very poor	Very poor	Fair	Fair
OpD, OXF	Very poor	Very poor	Fair	Fair
Pocono:				
PoB	Good	Good	Good	Good
PoC	Fair	Good	Good	Good
PpB, PpD	Very poor	Very poor	Good	Good
Pope: Ps	Good	Good	Good	Good
Rexford:				
RdA	Fair	Good	Good	Good
RdB	Fair	Good	Good	Good
Shelmadine:				
ShA	Poor	Fair	Fair	Fair
SkB	Very poor	Very poor	Fair	Fair
Volusia:				
VoB	Fair	Good	Good	Good
VoC	Fair	Good	Good	Good
VrB	Very poor	Poor	Good	Good
VrC	Very poor	Poor	Good	Good
Wayland: Wa	Very poor	Poor	Poor	Poor
Weikert:				
WeB	Very poor	Poor	Poor	Very poor
WeC, WeD	Very poor	Poor	Poor	Very poor
Wellsboro:				
WlB	Fair	Good	Good	Good
WlC	Fair	Good	Good	Good
WlD	Poor	Fair	Good	Good
WmB	Very poor	Poor	Good	Good
WmD	Very poor	Poor	Good	Good
Wurtsboro:				
WrB	Fair	Good	Good	Good
WrC	Fair	Good	Good	Good
WrD	Poor	Fair	Good	Good
WtB	Very poor	Very poor	Good	Good
WtD	Very poor	Very poor	Good	Good
Wyoming:				
WyD	Poor	Fair	Fair	Poor
WyF	Very poor	Poor	Fair	Poor

Wildlife habitat—Continued

Potential for habitat elements			Potential as habitat for—		
Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Fair	Poor	Very poor	Fair	Fair	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Poor	Very poor	Good	Good	Very poor.
Fair	Good	Good	Fair	Fair	Good.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Poor	Good	Good	Poor	Poor	Good.
Very poor	Poor	Very poor	Poor	Very poor	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Good	Very poor.
Good	Very poor	Very poor	Poor	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Good	Good	Very poor.
Good	Very poor	Very poor	Fair	Good	Very poor.
Good	Poor	Very poor	Poor	Fair	Very poor.
Good	Very poor	Very poor	Poor	Fair	Very poor.
Poor	Very poor	Very poor	Fair	Poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.

TABLE 5.—*Soil limitations for town and country planning*

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill (trench)[1]
Alluvial land: Ag	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Alvira:						
AlB	Severe: seasonal high water table; slow permeability.	Moderate: slope; inflow hazard.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
AnB	Severe: seasonal high water table; slow permeability.	Moderate: slope; inflow hazard; stony.	Severe: seasonal high water table.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
Arnot:						
ArB	Severe: depth to bedrock; rocky.	Severe: depth to bedrock; stony.	Severe: depth to bedrock.	Severe: depth to bedrock; stony.	Severe: depth to bedrock.	Severe: depth to bedrock.
ArD	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock.	Severe: depth to bedrock.
ASF. Rock outcrop part too variable to rate.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.
Atherton: At	Severe: high water table; slow permeability.	Severe: moderately rapid permeability in substratum; inflow hazard.	Severe: high water table.	Severe: high water table.	Severe: high water table; frost action potential.	Severe: high water table; moderately rapid permeability in substratum.
Basher: Bf	Severe: seasonal high water table; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
Bath:						
BkB	Severe: slow permeability.	Moderate: slope; coarse fragments.	Slight	Slight	Slight	Slight.
BkC	Severe: slow permeability.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope	Slight.
BkD	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
BnB	Severe: slow permeability.	Moderate: slope; coarse fragments; stony.	Moderate: stony	Moderate: stony	Slight	Moderate: stony.
BnD	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony.
Braceville:						
BrA	Severe: seasonal high water table; slow permeability.	Severe: moderately rapid permeability in substratum.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
BrB	Severe: seasonal high water table; slow permeability.	Severe: slope; moderately rapid to rapid permeability in substratum.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
BrC	Severe: seasonal high water table; slow permeability.	Severe: slope; moderately rapid to rapid permeability in substratum.	Moderate: slope; seasonal high water table.	Moderate: slope	Moderate: slope; frost action potential.	Severe: seasonal high water table.

Buchanan:						
BuB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; inflow hazard.	Moderate: seasonal high water table.	Slight	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
BxB	Severe: seasonal high water table; stony; slow permeability.	Severe: stony	Severe: stony	Severe: stony	Moderate: seasonal high water table; stony; frost action potential.	Severe: seasonal high water table; stony.
BxD	Severe: slope; seasonal high water table; stony; slow permeability.	Severe: slope; stony	Severe: slope; stony	Severe: slope; stony	Severe: slope	Severe: seasonal high water table; stony.
Chenango:						
ChA, ChB	Slight[2]	Severe:[2] moderately rapid to rapid permeability in substratum.	Slight	Slight	Slight	Severe: moderately rapid to rapid permeability.
ChC	Moderate:[2] slope	Severe:[2] slope; moderately rapid to rapid permeability in substratum.	Moderate: slope	Moderate: slope	Moderate: slope	Severe: moderately rapid to rapid permeability.
Chippewa:						
ClA	Severe: high water table; very slow permeability.	Moderate: coarse fragments; inflow hazard.	Severe: high water table.	Severe: high water table.	Severe: high water table; frost action potential.	Severe: high water table.
ClB	Severe: high water table; very slow permeability.	Moderate: slope; coarse fragments; inflow hazard.	Severe: high water table.	Severe: high water table.	Severe: high water table; frost action potential.	Severe: high water table.
CnB	Severe: high water table; very slow permeability.	Moderate: slope; coarse fragments; inflow hazard; stony.	Severe: high water table.	Severe: high water table.	Severe: high water table; frost action potential.	Severe: high water table.
Dekalb:						
DdB	Severe: depth to bedrock; stony.	Severe: depth to bedrock; moderately rapid permeability; stony.	Severe: depth to bedrock; stony.	Severe: stony	Moderate: depth to bedrock; stony; rocky.	Severe: stony; moderately rapid permeability.
DdD	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock; moderately rapid permeability; stony.	Severe: slope; depth to bedrock; stony.	Severe: slope; stony	Severe: slope	Severe: stony; moderately rapid permeability.
DEF	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock; moderately rapid permeability; stony.	Severe: slope; depth to bedrock; stony.	Severe: slope; stony	Severe: slope	Severe: slope; stony; moderately rapid permeability.
Holly: Ho	Severe: high water table; subject to flooding; moderately slow permeability.	Severe: subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding; frost action potential.	Severe: high water table; subject to flooding.
Kedron:						
KdB	Severe: seasonal high water table; slow permeability.	Moderate: slope; fragments; inflow hazard.	Moderate: seasonal high water table.	Slight	Moderate: frost action potential.	Severe: seasonal high water table.
KdC	Severe: seasonal high water table; slow permeability.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: slope	Moderate: slope; frost action potential.	Severe: seasonal high water table.
KeB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; inflow hazard; stony.	Moderate: seasonal high water table; stony.	Moderate: stony	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.

TABLE 5.—*Soil limitations for town and country planning*—Continued

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill (trench)[1]
KeC	Severe: slope; seasonal high water table; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.
KwB	Severe: seasonal high water table; slow permeability.	Moderate: slope; inflow hazard; coarse fragments.	Severe: seasonal high high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
KxB	Severe: seasonal high water table; slow permeability.	Moderate: slope; inflow hazard; coarse fragments; stony.	Severe: seasonal high water table.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
Lackawanna:						
LaB	Severe: slow permeability.	Moderate: slope; coarse fragments.	Slight	Slight	Slight	Slight.
LaC	Severe: slow permeability.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope	Slight.
LaD	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
LcB	Severe: slow permeability.	Moderate: slope; coarse fragments; stony.	Moderate: stony	Moderate: stony	Slight	Moderate: stony.
LcD	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony.
LEF For Bath part of LEF, see Bath series.	Severe: slope; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Leck Kill:						
LkB	Moderate: depth to bedrock.	Severe: moderately rapid permeability.	Slight	Slight	Slight	Severe: moderately rapid permeability; depth to bedrock.
LkC	Moderate: slope; depth to bedrock.	Severe: slope; moderately rapid permeability.	Moderate: slope	Moderate: slope	Moderate: slope	Severe: moderately rapid permeability; depth to bedrock.
LkD	Severe: slope	Severe: slope; moderately rapid permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: moderately rapid permeability; depth to bedrock.
Linden: Ln	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	Severe: subject to flooding.	Slight	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability; texture.
Mardin:						
MaB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments.	Moderate: seasonal high water table.	Slight	Slight	Severe: seasonal high water table.
MaC	Severe: seasonal high water table; slow permeability.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: slope	Moderate: slope	Severe: seasonal high water table.
MaD	Severe: slope; seasonal high water table; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.
McB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; stony.	Moderate: seasonal high water table; stony.	Moderate: stony	Slight	Severe: seasonal high water table.

McD	Severe: slope; seasonal high water table; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.
Meckesville:						
MeB	Severe: moderately slow permeability.	Moderate: slope; coarse fragments.	Slight	Slight	Slight	Slight.
MeC	Severe: moderately slow permeability.	Severe: slope	Moderate: slope	Moderate: slope	Moderate: slope	Slight.
MeD	Severe: slope; moderately slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
MfB	Severe: moderately slow permeability.	Moderate: slope; coarse fragments; stony.	Moderate: stony	Moderate: stony	Slight: slope	Moderate: stony.
MfD	Severe: slope; moderately slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Moderate: slope; stony.
Mine dump: Mg. Too variable to rate. Requires onsite investigation.						
Mine dump, burned: Mh. Too variable to rate. Requires onsite investigation.						
Mine wash: Mm. Too variable to rate. Requires onsite investigation.						
Morris:						
MoB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; inflow hazard.	Severe: seasonal high water table.	Moderate: seasonal water table.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
MoC	Severe: seasonal high water table; slow permeability.	Severe: slope	Severe: seasonal high water table.	Moderate: slope; seasonal high water table.	Moderate: slope; seasonal high water table; frost action potential.	Severe: seasonal high water table.
MsB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; inflow hazard; stony.	Severe: seasonal high water table.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
MsC	Severe: seasonal high water table; slow permeability.	Severe: slope	Severe: seasonal high water table.	Moderate: slope; seasonal high water table; stony.	Moderate: slope; seasonal high water table; frost action potential.	Severe: seasonal high water table.
Muck: Mu	Severe: high water table.	Severe: organic material; inflow hazard.	Severe: high water table; shrink-swell potential; organic material.	Severe: high water table; organic material.	Severe: high water table; frost action potential; organic material.	Severe: high water table; organic material.
Oquaga:						
OlB	Severe: depth to bedrock.	Severe: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth to bedrock.	Moderate: depth to bedrock.	Severe: depth to bedrock.
OlC	Severe: depth to bedrock.	Severe: slope; depth to bedrock.	Severe: depth to bedrock.	Moderate: slope; depth to bedrock.	Moderate: slope depth to bedrock.	Severe: depth to bedrock.
OlD	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope	Severe: slope	Severe: depth to bedrock.
OpB	Severe: depth to bedrock; stony.	Severe: depth to bedrock.	Severe: stony; depth to bedrock.	Severe: stony	Moderate: depth to bedrock; stony.	Severe: depth to bedrock; stony.

TABLE 5.—*Soil limitations for town and country planning*—Continued

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill (trench)[1]
OpD	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock.	Severe: slope; stony; depth to bedrock.	Severe: slope; stony.	Severe: slope	Severe: depth to bedrock; stony.
OXF Lordstown mapped only with Oquaga soils.	Severe: slope; depth to bedrock; stony.	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock.	Severe: slope; stony.	Severe: slope	Severe: slope; depth to bedrock; stony.
Pocono:						
PoB	Slight	Moderate: moderate permeability; slope; coarse fragments.	Slight	Moderate: surface texture.	Slight	Slight.
PoC	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope; surface texture.	Moderate: slope	Slight.
PpB	Severe: stony	Severe: stony	Severe: stony	Severe: stony	Moderate: stony	Severe: stony.
PpD	Severe: slope; stony.	Severe: slope; stony.	Severe: slope; stony.	Severe: slope; stony.	Severe: slope	Severe: stony.
Pope: Ps	Severe: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.	Severe: subject to flooding; moderately rapid permeability.
Rexford:						
RdA	Severe: seasonal high water table; slow permeability.	Moderate: coarse fragments; inflow hazard.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
RdB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; inflow hazard.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
Shelmadine:						
ShA	Severe: high water table; slow permeability.	Slight: inflow hazard.	Severe: high water table.	Severe: high water table.	Severe: high water table; frost action potential.	Severe: high water table.
SkB	Severe: high water table; slow permeability.	Moderate: slope; inflow hazard; stony.	Severe: high water table.	Severe: high water table.	Severe: high water table; frost action potential.	Severe: high water table.
Strip mine: Sm. Too variable to rate. Requires onsite investigation.						
Urban land: Ub. Too variable to rate. Requires onsite investigation.						
Urban land, rarely flooded: Uf. Too variable to rate. Requires onsite investigation.						

Volusia:						
VoB	Severe: seasonal high water table; very slow permeability.	Moderate: slope; inflow hazard; coarse fragments.	Severe: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
VoC	Severe: seasonal high water table; very slow permeability.	Severe: slope	Severe: seasonal high water table.	Moderate: slope; seasonal high water table.	Moderate: slope; seasonal high water table; frost action potential.	Severe: seasonal high water table.
VrB	Severe: seasonal high water table; very slow permeability.	Moderate: slope; coarse fragments; stony; inflow hazard.	Severe: seasonal water table.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; frost action potential.	Severe: seasonal high water table.
VrC	Severe: seasonal high water table; very slow permeability.	Severe: slope	Severe: slope; seasonal high water table.	Moderate: slope; seasonal high water table; stony.	Severe: slope	Severe: seasonal high water table
Wayland: Wa	Severe: high water table; subject to flooding; slow permeability.	Severe: subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding; frost action potential.	Severe: high water table; subject to flooding.
Weikert:						
WeB	Severe: depth to bedrock.	Severe: depth to bedrock; moderately rapid permeability.	Moderate: depth to bedrock.	Severe: depth to bedrock.	Moderate: depth to bedrock.	Severe: depth to bedrock; moderately rapid permeability.
WeC	Severe: depth to bedrock.	Severe: slope; depth to bedrock; moderately rapid permeability.	Moderate; slope; depth to bedrock.	Severe: depth to bedrock.	Moderate: slope; depth to bedrock.	Severe: depth to bedrock; moderately rapid permeability.
WeD	Severe: slope; depth to bedrock.	Severe: slope; depth to bedrock; moderately rapid permeability.	Severe: slope	Severe: slope; depth to bedrock.	Severe: slope	Severe: depth to bedrock; moderately rapid permeability.
Wellsboro:						
WlB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments.	Moderate: seasonal high water table.	Slight	Slight	Severe: seasonal high water table.
WlC	Severe: seasonal high water table; slow permeability.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate slope	Moderate: slope	Severe: seasonal high water table; slope.
WlD	Severe: slope; seasonal high water table; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.
WmB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments; stony.	Moderate: seasonal high water table; stony.	Moderate: stony	Slight	Severe: seasonal high water table.
WmD	Severe: slope; seahigh water table; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.
Wurtsboro:						
WrB	Severe: seasonal high water table; slow permeability.	Moderate: slope; coarse fragments.	Moderate: seasonal high water table.	Slight	Slight	Severe: seasonal high water table.
WrC	Severe: seasonal high water table; slow permeability.	Severe: slope	Moderate: slope; seasonal high water table.	Moderate: slope	Moderate: slope	Severe: seasonal high water table.
WrD	Severe: slope; seasonal high water table; slow permeability.	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: seasonal high water table.

TABLE 5.—*Soil limitations for town and country planning*—Continued

Soil series and map symbols	Septic tank absorption fields	Sewage lagoons	Dwellings with basements	Lawns and landscaping	Local roads and streets	Sanitary landfill (trench)[1]
WtB	Severe: seasonal high water table; stony; slow permeability.	Severe: stony.	Severe: stony.	Severe: stony.	Slight.	Severe: seasonal high water table.
WtD	Severe: slope; seasonal high water table; stony; slow permeability.	Severe: slope; stony.	Severe: slope; stony.	Severe: slope; stony.	Severe: slope.	Severe: seasonal high water table.
Wyoming: WyD	Severe:[2] slope.	Severe:[2] slope; coarse fragments; rapid permeability.	Severe: slope.	Severe: slope; coarse fragments.	Severe: slope.	Severe: slope; rapid permeability.
WyF	Severe:[2] slope.	Severe: slope; coarse fragments; rapid permeability.	Severe: slope.	Severe: slope; coarse fragments.	Severe: slope.	Severe: slope; rapid permeability.

[1]Onsite study is needed of the underlying strata, the water table, and the hazard of aquifer pollution into ground water in landfill deeper than 5 or 6 feet.
[2]Possible ground water pollution because of coarse texture and rapid permeability.

depth to the water table, shrink-swell potential, depth to and kind of bedrock, soil texture, percent of slope, potential frost action, and hazard of flooding (fig. 10).

For lawns and landscaping at homesites, it is assumed that adequate amounts of lime and fertilizer are used. Suitable soil material is needed in sufficient quantities so that desirable trees (fig. 11) and other plants can survive and grow well. Among the important soil properties for lawns and landscaping are depth to bedrock or layers that restrict water and roots, texture, slope, depth to the water table, and the presence of stones or rocks.

Local roads and streets, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand. Most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are the load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Sanitary landfill is a method of disposing of refuse. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 5 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be deeper. For some soils reliable predictions can be made to a depth of 10 to 15 feet, but every site should be investigated before it is selected.

Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 6 the soils of Luzerne County are rated according to limitations that affect their use for camp areas, service buildings, paths and trails, picnic areas, playgrounds, and golf fairways.

In table 6 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all ratings it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or

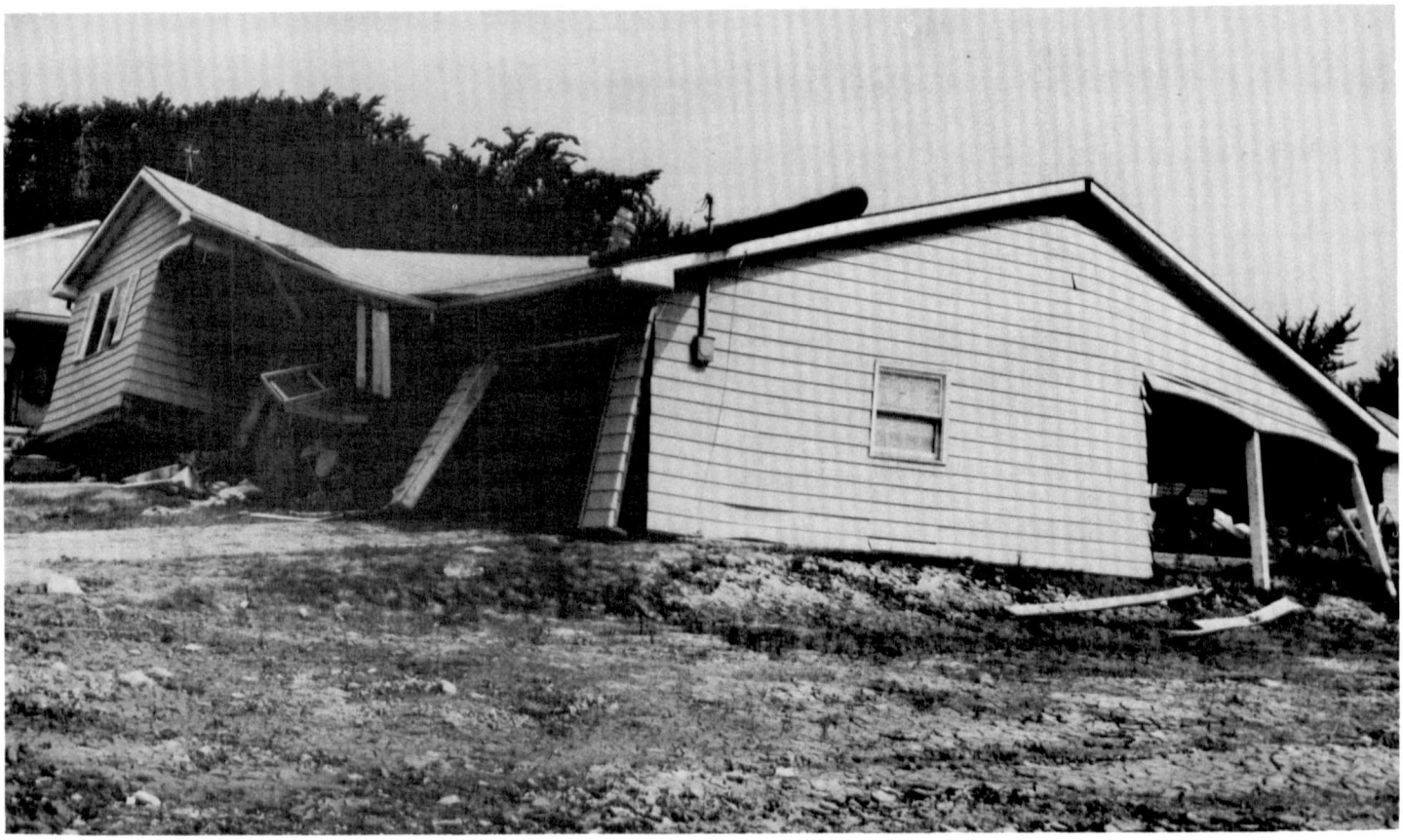

Figure 10.—Home on Pope soil destroyed by flooding. The utility pole on the roof indicates the water height.

modified by planning, design, or special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required other than shaping and leveling for tent and parking areas. Camp sites are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Service buildings and dwellings, as rated in table 6, are without basements, are no more than three stories high, and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for service buildings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, content of stones, and outcrops of bedrock.

Paths and trails are used for local and cross country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded no more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increases cost of leveling sites or building access roads.

Playgrounds are used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, no flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Golf fairways are used intensively and are subject to heavy foot traffic. Most of the vehicular traffic is confined to hard surface trails and roads. The best soils

TABLE 6.—*Soil limitations for recreational development*

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Alluvial land: Ag. Too variable to rate. Requires onsite investigation.						
Alvira:						
AlB	Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.
AnB	Moderate: stony; seasonal high water table; slow permeability.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table; stony.
Arnot:						
ArB	Severe: stony; rocky.	Severe: depth to bedrock; rocky; stony.	Severe: stony.	Moderate: stony.	Severe: rocky; stony; depth to bedrock.	Severe: depth to bedrock; rocky; stony.
ArD	Severe: slope; stony; rocky.	Severe: slope; depth to bedrock; rocky; stony.	Severe: stony.	Severe: slope.	Severe: slope; depth to bedrock; stony; rocky.	Severe: slope; depth to bedrock; rocky; stony.
ASF. Rock outcrop too variable to rate.	Severe: slope; stony; rocky.	Severe: slope; depth to bedrock; rocky; stony.	Severe: slope; stony.	Severe: slope.	Severe: slope; depth to bedrock; rocky; stony.	Severe: slope; depth to bedrock; rocky; stony.
Atherton: At	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Basher: Bf	Moderate: seasonal high water table; subject to flooding.	Severe: subject to flooding.	Slight.	Moderate: subject to flooding; seasonal high water table.	Moderate: seasonal high water table; subject to flooding.	Moderate: seasonal high water table; subject to flooding.
Bath:						
BkB	Moderate: slow permeability; coarse fragments.	Slight.	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
BkC	Moderate: slope; coarse fragments; slow permeability.	Moderate: slope.	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
BkD	Severe: slope.	Severe: slope.	Moderate: slope; coarse fragments.	Severe: slope.	Severe: slope; coarse fragments.	Severe: slope.
BnB	Moderate: slow permeability; stony.	Moderate: stony.	Moderate: stony.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments; stony.
BnD	Severe: slope.	Severe: slope.	Moderate: slope; stony.	Severe: slope.	Severe: slope; coarse fragments.	Severe: slope.
Braceville:						
BrA, BrB	Moderate: seasonal high water table; slow permeability; coarse fragments.	Slight.	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
BrC	Moderate: slope; seasonal high water table; slow permeability; coarse fragments.	Moderate: slope.	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.

Buchanan:						
BuB	Moderate: seasonal high water table; coarse fragments; slow permeability.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
BxB	Severe: stony	Severe: stony	Severe: stony	Moderate: stony	Severe: coarse fragments; stony.	Severe: stony.
BxD	Severe: slope; stony	Severe: slope; stony	Severe: stony	Severe: slope	Severe: slope; coarse fragments; stony.	Severe: slope; stony.
Chenango:						
ChA, ChB	Moderate: coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
ChC	Moderate: slope; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
Chippewa: ClA, ClB, CnB.	Severe: high water table; very slow permeability.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Dekalb:						
DdB	Severe: stony	Severe: stony	Severe: stony	Moderate: stony	Severe: stony	Severe: stony.
DdD	Severe: slope; stony	Severe: slope; stony	Severe: stony	Severe: slope	Severe: slope; stony	Severe: slope; stony.
DEF	Severe: slope; stony	Severe: slope; stony	Severe: slope; stony	Severe: slope	Severe: slope; stony	Severe: slope; stony.
Holly: Ho	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.	Severe: high water table.	Severe: high water table.	Severe: subject to flooding; high water table.	Severe: subject to flooding; high water table.
Kedron:						
KdB	Moderate: seasonal high water table; coarse fragments; slow permeability.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
KdC	Moderate: slope; slow permeability; seasonal high water table; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
KeB	Moderate: stony; slow permeability; seasonal high water table.	Moderate: stony	Moderate: stony	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments; stony.
KeC	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
KwB	Moderate: seasonal high water table; slow permeability; coarse fragments.	Moderate: seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Moderate: seasonal high water table; coarse fragments.	Severe: seasonal water table; coarse fragments.	Moderate: seasonal high water table; coarse fragments.
KxB	Moderate: seasonal high water table; stony; slow permeability.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Severe: seasonal high water table; coarse fragments.	Moderate: seasonal high water table coarse fragments; stony.
Lackawanna:						
LaB	Moderate: slow permeability; coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
LaC	Moderate: slope; slow permeability; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
LaD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
LcB	Moderate: stony; slow permeability.	Moderate: stony	Moderate: stony	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments; stony.

TABLE 6.—*Soil limitations for recreational development*—Continued

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
LcD	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
LEF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
For Bath part of LEF see Bath series.						
Leck Kill:						
LkB	Moderate: coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
LkC	Moderate: slope; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
LkD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
Linden: Ln	Moderate: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: subject to flooding.	Moderate: subject to flooding.	Moderate: subject to flooding.
Mardin:						
MaB	Moderate: slow permeability; seasonal high water table; coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
MaC	Moderate: slope; seasonal high water table; slow permeability; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
MaD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
McB	Moderate: seasonal high water table; slow permeability; stony; coarse fragments.	Moderate: stony	Moderate: stony	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments; stony.
McD	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
Meckesville:						
MeB	Moderate: coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
MeC	Moderate: slope; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
MeD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
MfB	Moderate: stony	Moderate: stony	Moderate: stony	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments; stony.
MfD	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
Mine dump: Mg. Too variable to rate. Requires onsite investigation.						

Mine dump, burned: Mh. Too variable to rate. Requires onsite investigation.						
Mine wash: Mm. Too variable to rate. Requires onsite investigation.						
Morris:						
MoB	Moderate: seasonal high water table; coarse fragments; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Moderate: seasonal high water table; coarse fragments.	Severe: seasonal high water table; coarse fragments.	Moderate: seasonal high water table; coarse fragments.
MoC	Moderate: slope; seasonal high water table; coarse fragments; slow permeability.	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Moderate: slope; seasonal high water table; coarse fragments.	Severe: slope; seasonal high water table; coarse fragments.	Moderate: slope; seasonal high water table; coarse fragments.
MsB	Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; stony.	Moderate: seasonal high water table; coarse fragments.	Severe: seasonal high water table; coarse fragments.	Moderate: seasonal high water table; stony; coarse fragments.
MsC	Moderate: seasonal high water table; slow permeability; stony.	Moderate: slope; seasonal high water table; stony.	Moderate: seasonal high water table; stony.	Moderate: slope; seasonal high water table; coarse fragments.	Severe: slope; seasonal high water table; coarse fragments.	Moderate: slope; seasonal high water table; stony; coarse fragments.
Muck: Mu	Severe: organic material; high water table.	Severe: high water table; shrink-swell potential.	Severe: organic material; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table.	Severe: organic material; high water table.
Oquaga:						
OlB	Moderate: coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: depth to bedrock; coarse fragments.
OlC	Moderate: slope; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; depth to bedrock; coarse fragments.
OlD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
OpB	Severe: stony	Severe: stony	Severe: stony	Moderate: stony	Severe: coarse fragments; stony.	Severe: stony.
OpD	Severe: slope; stony	Severe: slope; stony	Severe: stony	Severe: slope	Severe: slope; coarse fragments; stony.	Severe: slope; stony.
OXF Lordstown mapped only with Oquaga series.	Severe: slope; stony	Severe: slope; stony	Severe: slope; stony	Severe: slope	Severe: slope; coarse fragments; stony.	Severe: slope; stony.
Pocono:						
PoB	Moderate: coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
PoC	Moderate: slope; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
PpB	Severe: stony	Severe: stony	Severe: stony	Moderate: stony	Severe: stony	Severe: stony.
PpD	Severe: slope; stony	Severe: slope; stony	Severe: stony	Severe: slope	Severe: slope; stony.	Severe: slope; stony.
Pope: Ps	Moderate: subject to flooding.	Severe: subject to flooding.	Slight	Slight	Slight	Slight.
Rexford: RdA, RdB	Moderate: seasonal high water table; slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Moderate: seasonal high water table.	Severe: seasonal high water table.	Moderate: seasonal high water table.

TABLE 6.—*Soil limitations for recreational development*—Continued

Soil series and map symbols	Camp areas	Service buildings and dwellings without basements	Paths and trails	Picnic areas	Playgrounds	Golf fairways
Shelmadine: ShA, SkB	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.	Severe: high water table.
Strip mine: Sm. Too variable to rate. Requires onsite investigation.						
Urban land: Ub. Too variable to rate. Requires onsite investigation.						
Urban land, rarely flooded: Uf. Too variable to rate. Requires onsite investigation.						
Volusia:						
VoB	Severe: very slow permeability.	Moderate: seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Moderate: seasonal high water table; coarse fragments.	Severe: seasonal high water table; coarse fragments.	Moderate: seasonal high water table; coarse fragments.
VoC	Severe: very slow permeability.	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Moderate: slope; seasonal high water table; coarse fragments.	Severe: slope; seasonal high water table; coarse fragments.	Moderate: slope; seasonal high water table; coarse fragments.
VrB	Severe: very slow permeability.	Moderate: seasonal high water table; stony.	Moderate: stony; seasonal high water table.	Moderate: seasonal high water table; coarse fragments.	Severe: seasonal high water table; coarse fragments.	Moderate: stony; coarse fragments; seasonal high water table.
VrC	Severe: very slow permeability.	Moderate: slope; seasonal high water table.	Moderate: seasonal high water table; stony.	Moderate: slope; seasonal high water table; coarse fragments.	Severe: slope; seasonal high water table; coarse fragments.	Moderate: slope; stony; channery fragments; seasonal high water table.
Wayland: Wa	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.	Severe: high water table; subject to flooding.
Weikert:						
WeB	Moderate: coarse fragments.	Moderate: depth to bedrock.	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: depth to bedrock; coarse fragments.	Severe: depth to bedrock.
WeC	Moderate: slope; coarse fragments.	Moderate: slope; depth to bedrock.	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; depth to bedrock; coarse fragments.	Severe: depth to bedrock.
WeD Klinesville mapped only with Weikert series.	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; depth to bedrock; coarse fragments.	Severe: slope; depth to bedrock.
Wellsboro:						
WlB	Moderate: seasonal high water table; slow permeability; coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
WlC	Moderate: slope; seasonal high water table; slow permeability; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.

WlD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
WmB	Moderate: seasonal high water table; slow permeability; stony; coarse fragments.	Moderate: stony	Moderate: stony	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: stony; coarse fragments.
WmD	Severe: slope	Severe: slope	Moderate: slope; stony.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
Wurtsboro:						
WrB	Moderate: seasonal high water table; slow permeability; coarse fragments.	Slight	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments.	Moderate: coarse fragments.
WrC	Moderate: slope; seasonal high water table; slow permeability; coarse fragments.	Moderate: slope	Moderate: coarse fragments.	Moderate: slope; coarse fragments.	Severe: slope; coarse fragments.	Moderate: slope; coarse fragments.
WrD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
WtB	Severe: stony	Severe: stony	Severe: stony	Moderate: stony; coarse fragments.	Severe: stony; coarse fragments.	Severe: stony.
WtD	Severe: slope; stony	Severe: slope; stony	Severe: stony	Severe: slope	Severe: slope; coarse fragments; stony.	Severe: slope; stony.
Wyoming:						
WyD	Severe: slope	Severe: slope	Moderate: slope; coarse fragments.	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.
WyF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope; coarse fragments.	Severe: slope.

have good drainage, mild slopes, and a surface that is free of rocks and stones and is firm after rains but not dusty when dry.

Engineering[6]

This section is useful to those who need information about soils used as structural material or as foundations upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 7 and 8, which show, respectively, estimates of soil properties significant in engineering and interpretations for selected engineering uses. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 7 and 8, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works. Inspection of sites is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meanings to soil scientists that might not be familiar to engineers. The Glossary defines many terms commonly used in soil science.

[6] SAMUEL E. YOUNG, engineer, Soil Conservation Service, helped prepare this section.

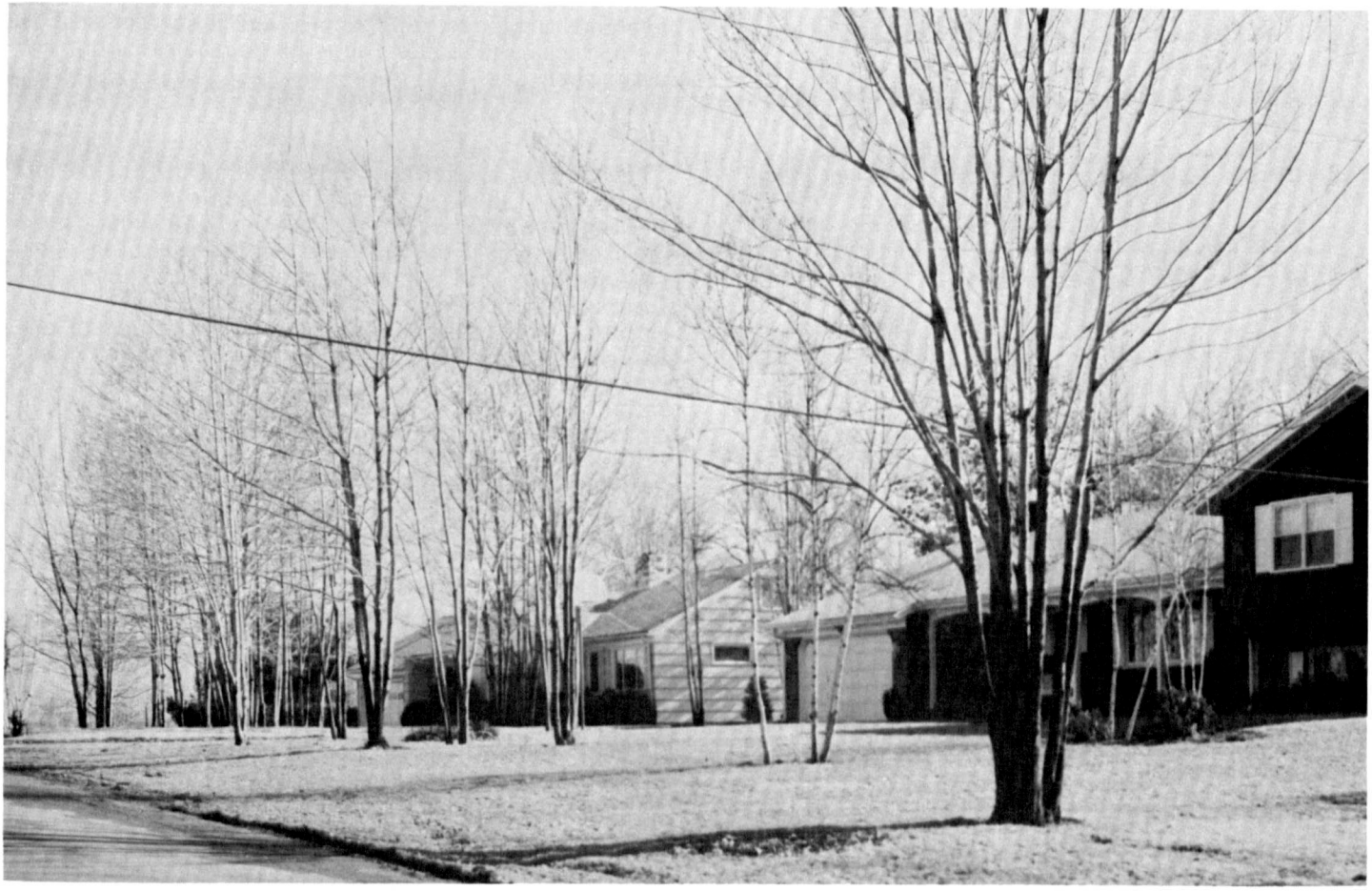

Figure 11.—Trees preserved in housing development on Wellsboro channery silt loam, 3 to 8 percent slopes, lower landscaping costs and add to esthetic appearance.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*3*) used by the SCS engineers, Department of Defense, and others, and the AASHTO (*2*) adopted by the American Association of State Highway and Transportation Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and content of organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is classified in one of seven basic groups ranging from A-1 to A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils, which have high bearing strength and are the best soils for subgrade, or foundation. At the other extreme, in group A-7, are clay soils, which have low strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated classification, without group index numbers, is given in table 7 for all soils mapped in the survey area.

Estimated soil properties significant in engineering

Estimates of soil properties significant in engineering are given in table 7. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 7.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Soil texture is described in table 7 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Permeability is the quality that enables a soil to transmit water or air. It is estimated on the basis of these soil characteristics observed in the field, particularly structure and texture. The estimates in table 7 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of a soil to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crops.

Reaction is the degree of acidity of alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Compaction, or moisture-density, data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density.* As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks when dry or swells when wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosion potential, as used in table 7, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion on uncoated steel is related to soil properties, such as drainage, texture, total acidity, and electrical conductivity of the soil material. Ratings of soils for corrosion on concrete are based mainly on soil texture and acidity. Installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosion rating of *low* indicates a low probability of soil-induced corrosion damage. A rating of *high* indicates a high probability of damage. Protective measures for steel and more resistant concrete should be used to avoid or minimize the risk.

Engineering interpretations

The estimated interpretations in table 8 are based on the engineering properties of soils shown in table 7, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Luzerne County. In table 8 ratings are used to summarize suitability of the soils for all listed purposes other than for highway location, pond reservoir areas, embankments, drainage, sprinkler irrigation, terraces or diversions, grassed waterways, winter grading, and pipeline construction and maintenance. For these particular uses, table 8 lists those soil features not to be overlooked in planning, installation, and maintenance.

Suitability of the soil as a source of topsoil, sand and gravel, and road fill is expressed as *good, fair, poor,* or *unsuitable.*

Following are explanations of some of the columns in table 8:

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material, as in preparing a seedbed; the natural fertility of the material, or the response of plants when fertilizer is applied; and the absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability. Also considered in the ratings is damage that will result in the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the material, nor do they indicate quality of the deposit.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and the ease of excavating the material at borrow areas.

Soil properties that most affect highway and road location are the load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified Classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding (fig. 12) affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

TABLE 7.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. Because

referring to other series that appear in the first column of this table.

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Unified
	Ft	*Ft*	*In*	*Pct*					
Alluvial land: Ag. Too variable to estimate. Requires onsite investigation.									
Alvira: AlB, AnB	½–1½	>5	0–22	0–5	80–100	60–95	60–90	55–85	ML, CL
			22–60	0–10	60–100	45–95	40–90	35–90	ML, CL, GM, GC
Arnot: ArB, ArD, ASF Rock outcrop too variable to rate.	>3	1–1½	0–3	5–15	55–75	40–60	40–60	30–55	ML, GM, SM
			3–17	5–30	55–65	45–55	40–50	30–40	GM, SM
			17						
Atherton: At	0–½	>6	0–6	0	90–100	70–100	65–90	60–85	ML
			6–37	0	75–100	70–100	50–90	40–80	SM, ML, CL
			37–60	0	45–95	35–95	25–85	20–50	GM, GP, SM
Basher: Bf	1–3	>6	0–53	0	90–100	75–100	70–100	50–95	ML
			53–62	0–10	45–100	35–100	20–95	20–75	ML, SM, GM, GP
Bath: BkB, BkC, BkD, BnB, BnD.	>3	>6	0–29	10–20	60–95	55–90	50–60	40–50	SM, GM, GC
			29–60	10–30	40–80	30–75	20–70	10–50	SM, SC, GP-GM, GC
Braceville: BrA, BrB, BrC	1½–3	>5	0–30	5–15	65–100	60–90	40–90	25–80	ML, SM
			30–55	5–10	50–90	40–75	35–70	15–50	GM, SM
			55–60	5–20	30–70	30–45	15–45	5–35	GP-GM, SM, SC
Buchanan: BuB, BxB, BxD	1½–3	>5	0–20	5–30	50–100	45–95	40–90	20–80	GM, GC, SM, SC, ML, CL
			20–60	10–40	45–80	40–75	25–70	20–60	GM, GC, SM, SC, ML, CL
Chenango: ChA, ChB, ChC	>6	>6	0–5	5–15	55–90	50–70	25–70	15–45	SM, GM
			5–24	5–20	40–80	30–70	20–70	10–60	GW-GM, SM, ML
			24–60	5–20	35–40	25–35	10–20	1–12	GW, GP, GP-GM
Chippewa: ClA, ClB, CnB	0–½	>5	0–9	0–15	70–100	65–90	65–85	60–80	ML, CL
			9–20	0–15	65–95	65–90	60–85	40–80	SM, ML, CL, GM
			20–60	10–20	65–90	50–70	40–60	30–60	ML, SM, GM

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the soils in such mapping units can have different properties and limitations, it is necessary to follow carefully the instructions for
The symbol > means more than; the symbol < means less than]

Classification (cont.) AASHTO	USDA texture	Range in permeability	Range in available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
								Steel	Concrete
		In/hr	*In/in of soil*	*pH*	*Pct*	*Lb/ft³*			
A–4, A–6	Silt loam, channery silty clay loam.	0.6–2.0	0.16–0.20	3.6–5.5			Low	High	High.
A–4, A–6, A–7	Channery clay loam, loam, silty clay loam.	0.06–0.2	0.08–0.12	3.6–5.5	14–18	105–115	Low	High	High.
A–2, A–4	Flaggy silt loam	0.6–2.0	0.10–0.15	3.6–5.5			Low	Low	High.
A–2, A–4	Channery silt loam, channery loam.	0.6–2.0	0.08–0.12	3.6–5.5	9–13	115–125	Low	Low	High.
	Sandstone bedrock.								
A–4	Silt loam	0.06–0.2	0.12–0.20	5.1–6.0			Low	High	Moderate.
A–4	Silt loam, silty clay loam.	0.06–0.2	0.10–0.19	5.1–6.0	12–15	112–118	Low	High	Moderate.
A–1, A–2, A–4	Very fine sand, very gravelly sand.	2.0–6.0	0.02–0.06	5.6–6.5	6–12	115–120	Low	High	Moderate.
A–4	Silt loam, loam, fine sandy loam.	0.6–2.0	0.14–0.20	3.6–5.5			Low	Moderate	High.
A–1, A–2, A–4	Very gravelly sand	0.6–2.0	0.06–0.20	4.5–6.0	8–12	115–125	Low	Moderate	High.
A–4, A–6	Channery silt loam, channery loam, silt loam.	0.6–2.0	0.08–0.12	4.5–6.0	11–20	102–120	Low	Low	High.
A–1, A–2, A–4	Very channery loam.	0.06–0.2	0.06–0.10	4.5–6.5	8–14	118–129	Low	Moderate	High.
A–1, A–2, A–4, A–6	Gravelly loam, silt loam, gravelly silt loam, cobbly silt loam.	0.6–2.0	0.08–0.14	4.5–6.0	15–20	100–110	Low	Moderate	High.
A–1, A–2, A–4	Cobbly loam, gravelly loam.	0.06–0.2	0.08–0.12	5.1–6.5	10–18	105–122	Low	Moderate	Moderate.
A–1, A–2	Stratified sands and gravel.	2.0–20.0	0.03–0.18	5.1–6.5	6–11	124–140	Low	Moderate	Moderate.
A–1, A–2, A–4	Channery loam, loam, gravelly loam.	0.6–2.0	0.06–0.12	3.5–5.5	12–16	115–120	Low	Moderate	High.
A–1, A–2, A–4	Gravelly loam, very gravelly loam.	0.06–0.2	0.06–0.12	3.6–5.5	12–16	114–120	Low	Moderate	High.
A–1, A–2, A–4	Gravelly loam	2.0–6.0	0.10–0.14	5.1–6.0			Low	Low	Moderate.
A–1, A–2, A–4	Gravelly silt loam, gravelly loam.	2.0–20.0	0.04–0.08	4.5–6.0	8–12	118–127	Low	Low	High.
A–1	Very gravelly loamy sand, very gravelly coarse sand.	2.0–20.0	0.00–0.02	4.5–6.0	8–12	118–127	Low	Low	High.
A–4	Silt loam	0.2–2.0	0.12–0.16	4.5–5.5			Moderate	High	High.
A–4	Channery silt loam	0.6–2.0	0.08–0.12	4.5–5.5	12–18	105–120	Low	High	High.
A–2, A–4	Channery loam, channery silt loam, very channery silt loam.	<0.06	0.08–0.12	5.1–7.0	10–15	115–122	Low	High	Moderate.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Unified
	Ft	*Ft*	*In*	*Pct*					
Dekalb: DdB, DdD, DEF	>6	1½–3½	0–6	0–30	50–85	40–75	35–65	15–55	SM, GM, ML
			6–21	10–40	50–85	40–80	40–75	20–55	ML, SM, GM
			21–28	10–50	45–85	35–75	25–65	15–40	SM, GM
			28						
Holly: Ho	0–½	>6	0–38	0	95–100	95–100	85–100	45–90	SM, SC, ML, CL
			38–60	0–10	70–100	65–100	55–100	30–85	ML, SM
Kedron: KdB, KdC, KeB, KeC, KwB, KxB.	½–3	>5	0–9	5–15	75–100	70–100	55–95	55–90	ML, CL
			9–22	5–15	80–100	75–100	60–100	40–95	ML, CL, SM, SC
			22–60	5–15	65–95	50–95	40–95	30–90	ML, CL, SM, SC, GM, GC
Klinesville	>6	1–½	0–9	5–15	45–75	40–75	20–50	12–40	GM, SM
Mapped only with Weikert soils.			9–17	5–25	30–60	20–50	15–40	4–30	SM, GM, GP, SP
			17						
*Lackawanna: LaB, LaC, LaD, LcB, LcD, LEF. For Bath part of LEF, see Bath series.	>3	>6	0–17	0–20	60–80	50–75	35–70	20–60	SM, ML, GM
			17–60	0–20	50–80	40–75	35–55	20–40	GM, GC, SM, SC
Leck Kill: LkB, LkC, LkD	>6	3½–5	0–10	0–5	60–85	60–80	40–80	20–70	ML, GM, SM
			10–27	0–20	45–90	45–85	25–80	20–70	GM, ML, SC, SM
			27–48	0–25	30–70	20–55	15–45	15–35	GM, GC, SC
			48						
Linden: Ln	>3	>5	0–45	0–5	90–100	75–100	70–100	20–65	ML, SM
			45–60	0–15	40–100	35–100	35–80	5–35	GM, SM, SP-SM, GP-GM
Lordstown	>6	1½–3½	0–8	0–15	60–80	55–75	30–55	25–45	SM, GM
Mapped only with Oquaga soils.			8–30	10–40	45–85	40–80	20–50	15–30	SM, GM, SC, GC
			30						
Mardin: MaB, MaC, MaD, McB, McD.	1½–3	>6	0–19	5–15	60–90	55–85	45–70	30–55	ML, SM, GM
			19–64	10–25	55–90	45–80	40–75	25–55	ML, GM, SM
Meckesville: MeB, MeC, MeD, MfB, MfD.	>3	>5	0–8	0–15	80–100	70–90	65–85	55–70	ML
			8–35	0–20	75–100	65–90	60–85	50–70	ML
			35–60	0–20	45–85	40–70	30–60	25–55	ML, SM, GM
Mine dump: Mg, Mh. Too variable to estimate. Requires onsite investigation.									

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Classification (cont.)	USDA texture	Range in permeability	Range in available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
AASHTO								Steel	Concrete
		In/hr	*In/in of soil*	*pH*	*Pct*	*Lb/ft³*			
A-1, A-2, A-4	Channery sandy loam.	2.0–6.0	0.08–0.12	3.6–5.5			Low	Low	High.
A-1, A-2, A-4	Channery sandy loam.	2.0–6.0	0.06–0.12	3.6–5.5	10–15	115–123	Low	Low	High.
A-1, A-2, A-4	Very channery sandy loam.	2.0–6.0	0.05–0.10	3.6–5.5	9–13	115–125	Low	Low	High.
	Sandstone bedrock.								
A-4, A-6	Silt loam, very fine sandy loam.	0.2–2.0	0.16–0.20	5.1–6.5	10–18	105–110	Low	High	Moderate.
A-2, A-4	Silty clay loam, silt loam.	0.2–2.0	0.08–0.16	5.6–7.3	8–15	110–125	Low	High	Moderate.
A-4	Channery silt loam..	0.6–2.0	0.14–0.20	3.6–5.5			Low	High	High.
A-4, A-6	Channery silt loam, silty clay loam.	0.2–2.0	0.08–0.14	3.6–5.5	12–16	105–120	Low	High	High.
A-2, A-4, A-6	Channery silt loam..	0.06–0.2	0.06–0.10	3.6–5.5	10–16	105–125	Low	High	High.
A-1, A-2, A-4	Channery silt loam..	2.0–6.0	0.08–0.12	4.5–5.5			Low	Low	High.
A-1, A-2	Very channery silt loam, channery silt loam.	2.0–6.0	0.04–0.08	4.5–5.5	11–15	114–120	Low	Low	High.
	Shale bedrock.								
A-1, A-2, A-4	Channery silt loam, channery loam.	0.6–2.0	0.10–0.14	4.5–5.5	11–16	110–122	Low	Low	High.
A-1, A-2, A-4	Channery silt loam, channery loam.	0.06–0.2	0.06–0.14	4.5–6.0	10–14	114–124	Low	Low	High.
A-1, A-2, A-4	Channery silt loam..	0.6–6.0	0.14–0.20	4.5–7.0			Low	Low	High.
A-1, A-2, A-4, A-6	Channery silty clay loam.	2.0–6.0	0.12–0.16	4.5–6.5	11–16	112–120	Low	Low	High.
A-1, A-2, A-4	Very channery silt loam.	2.0–6.0	0.04–0.08	4.5–6.0	11–16	110–122	Low	Low	High.
	Shale bedrock.								
A-2, A-4	Silt loam, very fine sandy loam, sandy loam.	2.0–6.0	0.14–0.18	3.6–6.0	12–16	110–120	Low	Low	High.
A-1, A-2	Very gravelly sand....	2.0–6.0	0.05–0.10	3.6–6.0	10–16	112–120	Low	Low	High.
A-2, A-4	Channery silt loam..	0.6–2.0	0.06–0.10	4.5–6.5			Low	Low	High.
A-1, A-2	Channery silt loam, very channery silt loam.	0.6–2.0	0.06–0.10	4.5–6.0	9–13	117–125	Low	Low	High.
	Shale bedrock.								
A-2, A-4	Channery silt loam, channery loam.	0.6–2.0	0.10–0.14	4.5–6.0	10–15	110–125	Low	Moderate	High.
A-2, A-4	Channery loam.....	0.06–0.2	0.06–0.10	4.5–6.5	8–12	115–125	Low	Moderate	High.
A-4	Channery silt loam..	0.6–2.0	0.14–0.18	3.6–5.0			Low	Low	High.
A-4	Silt loam, channery silt loam.	0.6–2.0	0.12–0.16	3.6–5.0	12–15	105–115	Low	Low	High.
A-2, A-4	Channery silt loam..	0.2–0.6	0.08–0.12	3.6–5.0	11–14	115–125	Low	Low	High.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Unified
	Ft	*Ft*	*In*	*Pct*					
Mine wash: Mm. Too variable to estimate. Requires onsite investigation.									
Morris: MoB, MoC, MsB, MsC.	½–1½	>5	0–16	0–20	60–95	55–90	45–85	40–65	ML, SM, GM
			16–60	0–20	60–95	50–90	40–85	35–70	ML, GM, SM
Muck: Mu	0	>5	0–68	0					Pt
*Oquaga: OlB, OlC, OlD, OpB, OpD, OXF. For Lordstown part, see Lordstown series.	>6	1½–3½	0–9	0–15	40–75	35–75	30–55	25–45	GM, SM, GC, SC
			9–35	5–15	35–75	20–75	20–60	15–50	SM, GM
			35						
Pocono: PoB, PoC, PpB, PpD.	>6	>6	0–5	0–5	55–80	45–75	40–60	20–30	GM, SM
			5–65	0–15	55–80	35–75	35–50	20–35	GM, SM
Pope: Ps	>3	>6	0–10	0	80–100	75–100	55–85	40–65	ML, SM
			10–62	0–5	50–100	50–100	40–100	20–90	ML, SM, GM
Rexford: RdA, RdB	½–1½	>6	0–18	0	85–100	80–100	70–90	45–70	ML, SM
			18–37	0	85–100	80–100	70–100	45–95	ML, SM
			37–60	0–20	60–90	55–80	40–70	25–55	ML, SM, GM
Shelmadine: ShA, SkB	0–½	>5	0–20	0–5	80–100	70–95	60–90	50–80	ML, CL
			20–60	0–10	0–90	60–90	55–80	45–65	ML, CL, GM, GC, SM, SC
Strip mine: Sm. Too variable to estimate. Requires onsite investigation.									
Urban land: Ub, Uf. Too variable to estimate. Requires onsite investigation.									
Volusia: VoB, VoC, VrB, VrC.	½–1½	>6	0–20	5–15	70–95	65–90	60–85	45–70	ML, GM, SM
			20–60	5–25	65–90	55–80	50–75	40–65	ML, CL, SM, GM
Wayland: Wa	0	>5	0–60	0	95–100	90–100	90–100	70–90	ML, CL
*Weikert: WeB, WeC, WeD. For Klinesville part, see Klinesville series.	>6	1–1½	0–8	0–10	40–70	35–65	25–65	20–55	GM, ML, SM
			8–17	0–20	25–55	20–50	10–35	5–30	GM, GP, SM
			17						
Wellsboro: WlB, WlC, WlD, WmB, WmD.	1½–3	>6	0–22	0–15	70–95	65–90	60–85	40–70	ML, SM, GM
			22–72	0–20	55–90	45–90	35–80	25–60	ML, GM, SM

significant in engineering—Continued

Classification (cont.)	USDA texture	Range in permeability	Range in available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
AASHTO								Steel	Concrete
		In/hr	*In/in of soil*	*pH*	*Pct*	*Lb/ft³*			
A-4	Channery silt loam, loam.	0.6–2.0	0.10–0.16	4.5–6.0	10–14	118–122	Low	High	High.
A-2, A-4, A-6	Channery silt loam, channery loam.	0.06–0.2	0.06–0.08	4.5–6.5	10–13	116–122	Low	High	High.
A-8	Muck, mucky peat	2.0–6.0	0.20–0.30	3.6–5.5			High	High	High.
A-2, A-4	Channery silt loam	0.6–2.0	0.10–0.16	4.5–5.5			Low	Low	High.
A-1, A-2, A-4	Channery silt loam, channery loam, very channery loam.	0.6–2.0	0.06–0.10	4.5–5.5	10–16	115–125	Low	Low	High.
	Shale bedrock.								
A-1, A-2	Gravelly sandy loam.	2.0–6.0	0.10–0.16	3.6–5.5			Low	Low	High.
A-1, A-2	Gravelly loam	0.6–2.0	0.08–0.14	3.6–5.5	10–15	116–124	Low	Low	High.
A-4	Silt loam	0.6–6.0	0.12–0.16	3.6–5.5			Low	Low	High.
A-1, A-2, A-4	Silt loam, loam	2.0–6.0	0.12–0.16	3.6–5.5	10–15	105–115	Low	Low	High.
A-4	Loam	0.6–2.0	0.14–0.18	4.5–6.0	15–21	100–112	Low	High	High.
A-4	Loam	0.06–0.2	0.06–0.10	5.1–6.5	15–21	100–112	Low	High	Moderate.
A-2, A-4	Gravelly loam, very gravelly loamy sand.	0.06–2.0	0.04–0.08	5.1–6.5	10–16	116–122	Low	High	Moderate.
A-4, A-6	Silt loam, gravelly silt loam.	0.2–0.6	0.14–0.18	3.6–5.5			Low	High	High.
A-4, A-6	Gravelly clay loam	0.06–0.2	0.10–0.14	3.6–5.5	11–14	114–122	Low	High	High.
A-4	Channery silt loam	0.6–2.0	0.14–0.18	4.5–6.5			Low	High	High.
A-4	Channery loam	<0.06	0.08–0.12	5.6–6.5	12–16	110–118	Low	High	Moderate.
A-4, A-6	Silt loam, silty clay loam.	0.06–0.2	0.14–0.20	6.6–7.8	15–20	103–111	Low	High	High.
A-1, A-2, A-4	Channery silt loam	2.0–6.0	0.08–0.14	4.5–5.5			Low	Low	High.
A-1, A-2	Channery silt loam, very channery silt loam.	2.0–6.0	0.04–0.08	4.5–5.5	11–15	115–122	Low	Low	High.
	Shale bedrock.								
A-4	Channery silt loam, gravelly silt loam.	0.2–2.0	0.10–0.14	4.5–6.0	10–15	110–120	Low	Moderate	High.
A-2, A-4	Channery silt loam	0.06–0.2	0.06–0.10	4.5–6.0	5–15	115–130	Low	Moderate	High.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface (typical profile)	Coarse fraction greater than 3 inches	Percentage passing sieve—				Classification
	Seasonal high water table	Bedrock			No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	Unified
	Ft	*Ft*	*In*	*Pct*					
Wurtsboro: WrB, WrC, WrD, WtB, WtD.	1½–3	>5	0–22	0–10	70–95	65–90	55–85	30–50	SM, GM
			22–60	5–25	65–90	50–85	50–80	25–50	SM, SC, GM, GC
Wyoming: WyD, WyF.....	>6	>6	0–22	5–20	50–90	40–70	20–60	15–40	SM
			22–60	5–25	30–80	20–65	5–50	1–12	GM, GP, SP-SM

Figure 12.—**Flood plain scour after flooding on Pope soil.**

significant in engineering—Continued

Classification (cont.) AASHTO	USDA texture	Range in permeability	Range in available water capacity	Reaction	Optimum moisture for compaction	Maximum dry density	Shrink-swell potential	Corrosion potential	
								Steel	Concrete
		In/hr	*In/in of soil*	*pH*	*Pct*	*Lb/ft³*			
A–2, A–4	Channery loam, channery fine sandy loam, channery sandy loam.	0.6–2.0	0.10–0.14	3.6–5.5	10–16	110–120	Low	Moderate	High.
A–2, A–4	Channery loam	0.06–0.2	0.06–0.10	3.6–5.5	9–15	113–125	Low	Moderate	High.
A–1, A–2, A–4	Gravelly loam, gravelly sandy loam, very gravelly sandy loam.	2.0–20.0	0.06–0.10	3.6–6.0	8–12	118–130	Low	Low	High.
A–1	Very gravelly loamy sand.	6.0–20.0	0.04–0.06	3.6–6.0	8–12	118–127	Low	Low	High.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Pond embankments require soil material that is resistant to seepage and piping and has favorable stability, shrink-swell potential, sheer strength, and compactibility. Stones and organic material in a soil are among the features that are unfavorable.

Drainage of crops and pasture is affected by such soil properties as permeability, texture, structure, depth to fragipan, rock, or other layers that influence rate of water movement; depth to the water table; slope and stability in ditchbanks; susceptibility to stream overflow; and availability of outlets for drainage.

Irrigation of a soil is affected by such soil features as slope; susceptibility to stream overflow and water erosion; texture; content of stones; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in a fragipan or another layer that restricts movement of water; amount of water available to plants; need for drainage; and depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and seepage so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; stones; permeability; and resistance to water erosion and soil slipping (fig. 13). A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Winter grading is affected chiefly by soil features that are relevant to moving, mixing, and compacting soil in road building when temperatures are below freezing.

Pipeline construction and other shallow excavations for sewer lines, phone and power transmission lines, basements, and open ditches generally require digging or trenching to a depth of less than 6 feet. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrop or large stones, and no flooding or high water table.

Formation and Classification of the Soils

This section describes the factors and processes of soil formation and the major soil horizons. It also shows the classification of the soils of the county according to current standards.

Factors of Soil Formation

Soils form through the interaction of five major factors: parent material, climate, plant and animal life, topography, and time. The relative influence of each factor generally varies from place to place. In places one factor may dominate the formation of a soil and determine most of its properties. In Luzerne County local variations in soils are primarily the result of

TABLE 8.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. instructions for referring to other series that

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering use for—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Alluvial land: Ag. Too variable to estimate. Requires onsite investigation.						
Alvira: AlB, AnB	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Poor: frost action potential.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; slow permeability.	Fair stability; medium to low shear strength; susceptible to piping.
Arnot: ArB, ArD, ASF. Rock outcrop too variable to rate.	Poor: limited quantities.	Poor: too silty.	Poor: thin layer.	Bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet.	Fair to good stability; low to medium compressibility; susceptible to piping; bedrock at a depth of 1 to 1½ feet.
Atherton: At	Poor: high water table.	Unsuitable; poor below a depth of 37 inches; high water table; too silty.	Poor: high water table.	High water table.	Pervious layers in substratum.	Medium to low shear strength; susceptible to piping; fair to poor compaction characteristics.
Basher: Bf	Good	Unsuitable	Fair: seasonal high water table.	Flood hazard; seasonal high water table.	Pervious layers in substratum; flood hazard.	Medium to low shear strength; susceptible to piping; fair to poor compaction characteristics.
Bath: BkB, BkC, BkD, BnB, BnD.	Poor: coarse fragments; surface stones on stony phases.	Poor: too silty.	Good	Seepage above fragipan; surface stones on stony phases.	Slow permeability.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Braceville: BrA, BrB, BrC.	Poor: coarse fragments.	Poor: too silty; good below a depth of 55 inches.	Good	Seasonal high water table; seepage above fragipan.	Pervious layers in lower substratum; seasonal high water table.	Medium to low shear strength; susceptible to piping; fair to poor compaction characteristics.
Buchanan: BuB, BxB, BxD.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Fair: seasonal high water table.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; can have pervious layers in substratum.	Low to medium compressibility; susceptible to piping; good to poor compaction characteristics.
Chenango: ChA, ChB, ChC.	Poor: coarse fragments.	Fair: too silty; good below a depth of 24 inches.	Good	Cut slopes are droughty.	Moderately rapid to rapid permeability.	Low to medium compressibility; medium to high permeability; susceptible to piping.
Chippewa: ClA, ClB, CnB.	Poor: high water table.	Unsuitable	Poor: high water table.	High water table; seepage above fragipan.	High water table; very slow permeability.	Medium to low shear strength; susceptible to piping; large stones on stony phases.

interpretations

Because the soils in such mapping units can have different properties and limitations, it is necessary to follow carefully the appear in the first column of this table]

Soil features affecting engineering use for—(cont.)					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Seasonal high water table; slow permeability.	Drainage needed; slow intake rate; seasonal high water table.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; high corrosion potential.
Well drained	Very low available water capacity; bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet; very low available water capacity.	Bedrock at a depth of 1 to 1½ feet; very low available water capacity.	No special problems.	Bedrock at a depth of 1 to 1½ feet.
High water table; limited outlets.	Drainage needed; high water table; slow intake rate.	High water table; limited outlets.	High water table; limited outlets.	High water table; forms large frozen clods.	High water table; subject to caving; high corrosion potential.
Flood hazard; seasonal high water table.	Seasonal high water table; flood hazard.	Not needed	Flood hazard; seasonal high water table.	Seasonal high water table.	Seasonal high water table; flood hazard; subject to caving.
Slow permeability; seepage above fragipan.	Slow permeability; moderate to low available water capacity.	Slow permeability; seepage above fragipan.	Seepage above fragipan; surface stones on stony phases.	No special problems.	Surface stones on stony phases.
Slow permeability; seasonal high water table.	Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability.	Seasonal high water table; seepage above fragipan.	Seasonal high water table.	Seasonal high water table; subject to caving.
Seasonal high water table; slow permeability.	Drainage needed; seasonal high water table; slow permeability.	Seasonal high water table; slow permeability.	Seasonal high water table; seepage above fragipan.	Seasonal high water table.	Seasonal high water table; stony.
Well drained	Very low to low available water capacity; moderately rapid to rapid permeability.	Irregular slopes	Irregular slopes; very low to low available water capacity.	No special problems.	Subject to caving.
High water table; very slow permeability.	Drainage needed; slow intake rate.	High water table; seepage above fragipan.	High water table; seepage above fragipan.	High water table; forms large frozen clods.	High water table; surface stones on stony phases; high corrosion potential.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering use for—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Dekalb: DdB, DdD, DEF.	Poor: coarse fragments; surface stones.	Unsuitable	Poor: thin layer.	Bedrock at a depth of 1½ to 3½ feet; surface stones.	Bedrock at a depth of 1½ to 3½ feet; permeable substratum.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Holly: Ho	Poor: high water table.	Unsuitable	Poor: high water table.	High water table; flood hazard.	Flood hazard; pervious layers in substratum; high water table.	Fair stability; medium to low shear strength; susceptible to piping.
Kedron: KdB, KdC, KeB, KeC.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Fair: frost action potential.	Seasonal high water table; seepage above fragipan; frost action potential.	Can have pervious layers in substratum; seasonal high water table.	Medium to low shear strength; medium compressibility; susceptible to piping; large stones on stony phases.
KwB, KxB	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Fair: frost action potential; seasonal high water table.	Seasonal high water table; seepage above fragipan; frost action potential.	Seasonal high water table; slow permeability.	Medium to low shear strength; medium compressibility; susceptible to piping; large stones on stony phases.
Klinesville Mapped only with Weikert soils.	Poor: coarse fragments.	Unsuitable	Poor: thin layer.	Bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet; moderately rapid permeability.	Bedrock at a depth of 1 to 1½ feet; low to medium compressibility; susceptible to piping.
*Lackawanna: LaB, LaC, LaD, LcB, LcD, LEF. For Bath part of LEF, see Bath series.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Good	Seepage above fragipan; stones on stony phases.	Slow permeability.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Leck Kill: LkB, LkC, LkD.	Poor: coarse fragments.	Unsuitable	Fair: frost action potential.	Bedrock at a depth of 3½ to 5 feet; moderate frost action potential; cuts and fills needed.	Moderately rapid permeability; bedrock at a depth of 3½ to 5 feet.	Low to medium compressibility; susceptible to piping; poor to good compaction characteristics.
Linden: Ln	Good	Unsuitable; good below a depth of 45 inches.	Good	Flood hazard	Flood hazard; moderately rapid permeability.	Medium to low shear strength; low to medium compressibility; susceptible to piping.
Lordstown Mapped only with Oquaga soils.	Poor: coarse fragments; surface stones on stony phases.	Poor: too silty.	Poor: thin layer.	Bedrock at a depth of 1½ to 3½ feet.	Bedrock at a depth of 1½ to 3½ feet; pervious substratum.	Bedrock at a depth of 1½ to 3½ feet; low to medium compressibility; susceptible to piping.
Mardin: MaB, MaC, MaD, McB, McD.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Poor: frost action potential.	Seasonal high water table; seepage above fragipan; frost action potential.	Seasonal high water table; slow permeability.	Low to medium compressibility; susceptible to piping; large stones on stony phases.

interpretations—Continued

Soil features affecting engineering use for—(cont.)					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Well drained; bedrock at a depth of 1½ to 3½ feet.	Moderate to very low available water capacity; bedrock at a depth of 1½ to 3½ feet.	Bedrock at a depth of 1½ to 3½ feet; surface stones.	Bedrock at a depth of 1½ to 3½ feet; surface stones.	Surface stones	Bedrock at a depth of 1½ to 3½ feet; surface stones.
High water table; flood hazard; limited outlets.	Drainage needed; flood hazard; high water table.	High water table; flood hazard.	High water table;flood hazard.	High water table	High water table; flood hazard; subject to caving; high corrosion potential.
Slow permeability; seasonal high water table.	Drainage needed; moderately slow intake rate; moderate available water capacity.	Seasonal high water table; seepage above fragipan.	Moderate available water capacity; seepage above fragipan; seasonal high water table.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; high corrosion potential.
Seasonal high water table; slow permeability.	Drainage needed; slow intake rate; seasonal high water table.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; seepage above fragipan; high corrosion potential.
Well drained; bedrock at a depth of 1 to 1½ feet.	Very low available water capacity; bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet; very low available water capacity.	No special problems	Bedrock at a depth of 1 to 1½ feet.
Slow permeability; seepage above fragipan.	Moderate to low available water capacity; slow permeability.	Slow permeability; seepage above fragipan.	Seepage above fragipan; moderate to low available water capacity.	No special problems	Surface stones on stony phases.
Well drained	Moderate intake rate; moderate to high available water capacity.	Bedrock at a depth of 3½ to 5 feet.	Bedrock at a depth of 3½ to 5 feet.	No special problems	Bedrock at a depth of 3½ to 5 feet.
Well drained	Flood hazard; moderately rapid permeability.	Not needed	Flood hazard	Forms frozen clods	Flood hazard; subject to caving.
Well drained; bedrock at a depth of 1½ to 3½ feet.	Low to very low available water capacity; bedrock at a depth of 1½ to 3½ feet.	Bedrock at a depth of 1½ to 3½ feet.	Bedrock at a depth of 1½ to 3½ feet; low to very low available water capacity.	No special problems	Bedrock at a depth of 1½ to 3½ feet; surface stones on stony phases.
Seasonal high water table; slow permeability.	Seasonal high water table; slow permeability; moderate to low available water capacity.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table.	Seasonal high water table; surface stones on stony phases.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering use for—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Meckesville: MeB, MeC, MeD, MfB, MfD.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Fair: frost action potential.	Some seepage above fragipan; frost action potential.	Moderately slow permeability.	Medium to low shear strength; susceptible to piping; fair to poor compaction characteristics; large stones on stony phases.
Mine dump: Mg. Too variable to estimate. Requires onsite investigation.						
Mine dump, burned: Mh. Too variable to estimate. Requires onsite investigation.						
Mine wash: Mm. Too variable to estimate. Requires onsite investigation.						
Morris: MoB, MoC, MsB, MsC.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Poor: frost action potential.	Seasonal high water table; seepage above fragipan; frost action potential.	Seasonal high water table; slow permeability.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Muck: Mu	Poor: high water table.	Unsuitable	Poor: organic material.	Poor: unsuitable soil conditions; high water table.	High water table; organic material.	Not suited to embankments.
*Oquaga: OlB, OlC, OlD, OpB, OpD, OXF. For Lordstown part, see Lordstown series.	Poor: coarse fragments; surface stones on stony phases.	Poor: too silty.	Poor: thin layer.	Bedrock at a depth of 1½ to 3½ feet.	Bedrock at a depth of 1½ to 3½ feet; pervious material.	Bedrock at a depth of 1½ to 3½ feet; low to medium compressibility; susceptible to piping.
Pocono: PoB, PoC, PpB, PpD.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Good	No special problems; surface stones on stony phases.	Permeable substratum.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Pope: Ps	Good	Unsuitable; locally good below a depth of 6 feet.	Good	Flood hazard	Pervious materials; flood hazard.	Medium to low shear strength; low to medium compressibility; susceptible to piping.
Rexford: RdA, RdB	Fair: coarse fragments.	Unsuitable; fair to good below a depth of 60 inches.	Poor: frost action potential.	Seasonal high water table; seepage above fragipan; frost action potential.	Seasonal high water table; pervious material in lower substratum.	Medium to low shear strength; low to medium compressibility; susceptible to piping.
Shelmadine: ShA, SkB	Poor: high water table; surface stones on stony phases.	Unsuitable	Poor: high water table.	High water table; seepage above fragipan.	High water table; slow permeability.	Fair stability; medium to low shear strength; susceptible to piping; large stones on stony phases.

interpretations—Continued

Soil features affecting engineering use for—(cont.)					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Some seepage above fragipan.	Moderately slow permeability; moderate available water capacity.	Moderately slow permeability; seepage above fragipan.	Seepage above fragipan.	Poor trafficability; forms frozen clods.	Contains stones in places.
Slow permeability; seasonal high water table.	Drainage needed; slow permeability; seasonal high water table.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table.	Seasonal high water table; seepage above fragipan; contains stones in places.
High water table; limited outlets; organic material.	Drainage needed; high water table.	Surface ponding; limited outlets.	High water table; limited outlets; surface ponding.	High water table; unstable; organic material.	High water table; unstable soil.
Well drained; bedrock at a depth of 1½ to 3½ feet.	Moderate to low available water capacity; bedrock at a depth of 1½ to 3½ feet.	Bedrock at a depth of 1½ to 3½ feet; moderate to low available water capacity.	Bedrock at a depth of 1½ to 3½ feet; moderate to low available water capacity.	No special problems..	Surface stones on stony phases.
Well drained.....	Moderate to high available water capacity.	Surface stones on stony phases.	Surface stones on stony phases.	No special problems..	Surface stones on stony phases.
Well drained; flood hazard.	Flood hazard; moderately rapid permeability.	Not needed.....	Flood hazard.....	Forms frozen clods.....	Flood hazard; subject to caving.
Slow permeability; seasonal high water table.	Drainage needed; slow permeability; seasonal high water table.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; seepage above fragipan; stones in places.
High water table; slow permeability.	Drainage needed; slow intake rate; high water table.	High water table; seepage above fragipan.	High water table; seepage above fragipan.	High water table; forms large frozen clods.	High water table; high corrosion potential.

TABLE 8.—*Engineering*

Soil series and map symbols	Suitability as source of—			Soil features affecting engineering use for—		
	Topsoil	Sand and gravel	Road fill	Highway and road location	Ponds	
					Reservoir area	Embankment
Strip mine: Sm. Too variable to estimate. Requires onsite investigation.						
Urban land: Ub. Too variable to estimate. Requires onsite investigation.						
Urban land, rarely flooded: Uf. Too variable to estimate. Requires onsite investigation.						
Volusia: VoB, VoC, VrB, VrC.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Fair: seasonal high water table.	Seasonal high water table; frost action potential; seepage above fragipan.	Seasonal high water table; very slow permeability.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Wayland: Wa	Poor: high water table.	Unsuitable	Poor: high water table.	High water table; flood hazard.	Pervious layers in substratum; flood hazard.	Medium to low shear strength; susceptible to piping; fair to poor compaction characteristics.
*Weikert: WeB, WeC, WeD. For Klinesville part, see Klinesville series.	Poor: coarse fragments.	Unsuitable	Poor: thin layer.	Bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet; moderately rapid permeability.	Bedrock at a depth of 1 to 1½ feet; low compressibility; medium to high permeability.
Wellsboro: WlB, WlC, WlD, WmB, WmD.	Poor: coarse fragments; surface stones on stony phases.	Unsuitable	Fair: frost action potential.	Seasonal high water table; frost action potential; seepage above fragipan.	Seasonal high water table; slow permeability.	Medium to low shear strength; susceptible to piping; large stones on stony phases.
Wurtsboro: WrB, WrC, WrD, WtB, WtD.	Poor: coarse fragments; surface stones on stony phases.	Poor: too silty.	Fair: frost action potential.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; slow permeability.	Low to medium compressibility; susceptible to piping; large stones on stony phases.
Wyoming: WyD, WyF	Poor: coarse fragments; slope.	Good	Fair: slope	Cut slopes are droughty.	Rapid permeability.	Good stability; high to medium permeability.

differences in kind of parent material and in topography and drainage.

Parent material

Parent material is the unconsolidated mass from which soils form. It determines the mineralogical and chemical composition of soils and to a large extent the rate at which soil-forming processes take place.

The soils in Luzerne County formed in glacial till, a mixture of glacial till and residuum, a mixture of glacial till and colluvium, glacial outwash, recent stream alluvium, and organic material. Most soil material was deposited or influenced by the glaciers, which melted 10,000 to 60,000 years ago. Alluvial and organic material is of recent origin and is still being deposited.

The soils that formed in glacial till are the most extensive in the county. They have a wide range of char-

interpretations—Continued

Soil features affecting engineering use for—(cont.)					
Drainage	Sprinkler irrigation	Terraces or diversions	Grassed waterways	Winter grading	Pipeline construction and maintenance
Seasonal high water table; very slow permeability.	Drainage needed; slow intake rate; seasonal high water table.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; forms large frozen clods.	Seasonal high water table; seepage above fragipan; surface stones on stony phases.
High water table; flood hazard; limited outlets.	Drainage needed; flood hazard; high water table.	High water table; limited outlets.	High water table; limited outlets.	High water table.....	High water table; flood hazard; subject to caving.
Well drained; bedrock at a depth of 1 to 1½ feet.	Very low available water capacity; bedrock at a depth of 1 to 1½ feet.	Bedrock at a depth of 1 to 1½ feet; very low available water capacity.	Bedrock at a depth of 1 to 1½ feet; very low available water capacity.	No special problems..	Bedrock at a depth of 1 to 1½ feet.
Seasonal high water table; slow permeability.	Seasonal high water table; slow intake rate; slow permeability.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table.	Seasonal high water table; seepage above fragipan; surface stones on stony phases.
Seasonal high water table; slow permeability.	Seasonal high water table; moderately slow intake rate.	Seasonal high water table; seepage above fragipan.	Seasonal high water table; seepage above fragipan.	Seasonal high water table.	Seasonal high water table; seepage above fragipan; surface stones on stony phases.
Well drained.....	Moderate to very low available water capacity; rapid permeability.	Irregular slopes.....	Moderate to very low available water capacity.	No special problems..	Subject to caving.

acteristics, but are characterized by a compact subsoil. Bath, Chippewa, Mardin, Morris, and Wellsboro soils are examples. Alvira, Pocono, and Shelmadine are examples of soils that formed in a mixture of glacial till and residuum. Buchanan, Kedron, and Meckesville soils formed in a mixture of glacial till and colluvium. Soils that formed in glacial outwash material on terraces are generally underlain by stratified sand and gravel. Examples are Braceville, Chenango, and Rexford soils. Soils on the flood plains formed in water-laid material called recent alluvium. Examples are Basher, Holly, Linden, and Wayland soils. Muck is an example of a soil that formed in organic material.

Climate

Luzerne County has a humid, continental climate, which affects the formation of soils by its influence on the rate at which rock weathers and minerals and or-

Figure 13.—Soil slipping in a steeply cut bank of Wellsboro channery silt loam, 8 to 15 percent slopes. Such problems can be reduced by adequate site investigation and engineering design.

ganic matter decompose. Temperature and temperature changes affect the differential expansion and contraction characteristics of minerals in the rocks and the rate of organic decomposition. The amount of precipitation affects the solubility of minerals in the rocks. Additional information on climate is provided in the section "General Nature of the County."

Plant and animal life

Living organisms are important to soil formation. These include vegetation, animals, bacteria, and fungi. Vegetation is generally responsible for the amount of organic matter, the color of the surface layer, and the amount of nutrients in the soil. Animals, such as earthworms and burrowing animals, help keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing nutrients for plants. In Luzerne County the native forests have had a profound influence on soil formation. Man also has greatly influenced the soil where he has cleared the forests and plowed the land. He has added fertilizers, mixed some of the soil horizons, and moved soil material from place to place.

Topography

The topography of Luzerne County has been affected by uplifted and folded geologic material and by glaciation. The county can be divided into two geologic regions: The Appalachian Plateau province and the Valley and Ridge province.

The Appalachian Plateau province, in the northern quarter of the county, is rolling to nearly level and has sharply dissected valley sides. In places it is dissected by steep sided valleys to a depth of 800 to 1,000 feet within a mile. The rolling to nearly level topography has local variations in elevation of 50 to 100 feet or more.

The Valley and Ridge province, in the southern three-quarters of the county, is characterized by several northeast-southwest trending mountains; by broad, rolling mountaintops; and by intermountain basins. It has differences in elevation of about 500 to 800 feet in less than a mile in the mountainous part. The broad, rolling mountaintops and the intermountain basins have local variations in elevation of about 100 to 200 feet in a mile or more.

Nearly all of the county has been glaciated. The

broad, rolling mountaintops and intermountain basins have been smoothed by glaciation resulting in a landscape with smooth curves rather than sharp, abrupt features. Thinner amounts of glacial till were deposited on the dissected valley sides and uplifted mountains than on the broad, rolling mountaintops and the intermountain basins.

The shape of the land surface, the slope, and the position of the water table have had great influence on the formation of soils in the county. Soils that formed in sloping areas where runoff is moderate to rapid generally are well drained; have a bright colored, unmottled subsoil; and in most places are leached to a greater depth than wetter soils in the same general area. In the more gently sloping areas where runoff is slower, there is generally evidence of short periods of wetness, such as mottling in the subsoil. In level areas or slight depressions where the water table is at or near the surface for long periods, the soils show marked evidence of wetness. They have a dark colored, thick surface layer and a strongly mottled or grayish subsoil. Some soils are wet because of a high water table. Others are wet because of their position on the landscape. Also, the permeability of the soil material, as well as the length, steepness, and configuration of the slopes influence the kind of soil that forms.

Time

The effect of plants and animals, climate, and topography in changing parent material into soil is governed by the length of time these factors have acted on the parent material. The degree of profile development generally indicates the age of a soil.

Linden, Basher, Holly, and Wayland soils, which are on flood plains, are the youngest soils in the county. Organic matter has accumulated on the surface of these soils, but their subsoil is less distinct than that in soils on uplands and terraces.

The soils on glaciated uplands show distinct time differences. The soils that formed in pre-Wisconsin glacial material have significant clay illuviation in the B horizon, which qualifies it as an argillic horizon. Examples of soils formed in this material are Meckesville, Leck Kill, Kedron, and Alvira soils. The younger soils that formed in Wisconsin glacial material also have clay illuviation, but only enough to qualify as cambic horizons. Lackawanna, Oquaga, Wellsboro, and Morris soils are examples.

Processes of Soil Formation

This section contains a brief description of the major soil horizons and a description of the processes that have much to do with the development of these horizons.

Major soil horizons

The results of the soil-forming factors can be distinguished by the different layers, or soil horizons, in a soil profile. The soil profile extends from the surface downward to material that is little altered by the soil-forming processes.

Most soils have three major horizons, called A, B, and C. These major horizons may be further divided by the use of numbers and letters to indicate changes within one horizon. An example is the B2t horizon, which is a B horizon that contains an accumulation of clay.

The A horizon is the surface layer. An A1 horizon is that part of the surface layer that has the largest accumulation of organic matter. The A horizon is also the layer of maximum leaching or eluviation of clay and iron. If considerable leaching has taken place and organic matter has not darkened the material, the horizon is called an A2. In some soils in Luzerne County the A2 horizon is brownish because of the oxidation of iron.

The B horizon, which underlies the A horizon, is commonly called the subsoil. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the surface layer. In some soils the B horizon forms by alteration in place rather than by illuviation. The alteration may be caused by oxidation and reduction of iron or by the weathering of clay minerals. The B horizon commonly has blocky or prismatic structure, and it generally is firmer and lighter colored than the A1 horizon but darker colored than the C horizon.

The C horizon is below the A and B horizons. It consists of material that is little altered by the soil-forming processes, but may be modified by weathering.

Processes of soil horizon differentiation

In Luzerne County several processes are involved in the formation of soil horizons. Among these are the accumulation of organic matter, the leaching of soluble salts, the reduction and transfer of iron, the formation of soil structure, and the formation and translocation of clay minerals. These processes are continually taking place, generally at the same time throughout the profile, and they have been going on for thousands of years.

The accumulation and incorporation of organic matter take place with the decomposition of plant residue. This process darkens the surface layer and helps to form the A1 horizon.

It is believed that some of the lime and other soluble salts are leached before the translocation of clay minerals. Among the factors that affect this leaching are the kinds of salts originally present, the depth to which the soil solution percolates, and the texture of the soil profile.

The well drained and moderately well drained soils in Luzerne County have a yellowish brown or reddish brown subsoil. These colors are caused mainly by thin coatings or iron oxides on sand and silt grains. In some soils, for example, Lackawanna, the colors are inherited from the reddish glacial material in which the soil formed. A weak to moderate subangular blocky structure has formed, but the subsoil contains little clay or no more clay than the overlying surface layer.

An important process of horizon differentiation in some soils in the county is the formation and translocation of clay minerals. The kinds and amount of clay

minerals in a soil profile depend on the kinds and amount of minerals in the parent material and on the length of time the clay minerals have undergone soil forming processes. The amount of clay varies from one horizon to another. Clay minerals are generally moved from the A horizon down into the B horizon. Evidence of such movement is greater clay content in the B horizon and clay films on ped faces, in pores, and along root channels in many soils. For example, clay films in the B2t horizon of Kedron channery silt loam are evidence of clay mineral translocation.

A fragipan has developed in the subsoil of nearly half of the soils in the county. These horizons are firm or very firm and brittle when moist and very hard when dry. Soil particles are so tightly packed that bulk density is high and pore space is low. Development of these horizons is not fully understood, but studies show that swelling and shrinking takes place in alternating wet and dry periods. This may account for the packing of soil particles and also for a gross polygonal pattern of cracks in the fragipan. Clay, silica, and oxides of aluminum are the most likely cementing agents causing brittleness and hardness.

The reduction and transfer of iron is associated mainly with the wetter, more poorly drained soils. This process is called gleying. Moderately well drained to somewhat poorly drained soils have yellowish brown and reddish brown mottles, which indicate the segregation of iron. In poorly drained and very poorly drained soils, such as Chippewa, Shelmadine, and Wayland, the subsoil and underlying material are grayish, which indicate reduction and transfer of iron by removal in solution.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification (*9*) currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*9*, *7*).

The current system of classification has six categories. Beginning with broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable (*11*). The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. Table 9 shows the classfication of each soil series of Luzerne County by family, subgroup, and order according to the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is identified by a word of three or four syllables ending in *sol* (Ent-i-sol). Table 9 shows the four soil orders in Luzerne County: Entisols, Inceptisols, Histosols, and Ultisols.

SUBORDER. Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. Each suborder is identified by a word of two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu*, meaning water or wet, and *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark red and dark brown colors associated with basic rocks, and the like. Each great group is identified by a word of three or four syllables; a prefix is added to the name of the suborder. An example is Fluvaquents (*Fluv*, meaning stream produced; *aqu*, for wetness or water; and *ent*, from Entisols).

SUBGROUP. Each great group is divided into subgroups, one representing the central (typic) segment of the group, and others called intergrades, which have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. Each subgroup is identified by the name of the great group preceded by adjectives. An example is Typic Fluvaquents (a typical Fluvaquent).

FAMILY. Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when

TABLE 9.—*Classification of soils*

Series	Family	Subgroup	Order
Alluvial land		Fluvaquents	Entisols.
Alvira	Fine-loamy, mixed, mesic	Aeric Fragiaquults	Ultisols.
Arnot	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Atherton variant	Fine-loamy, mixed, nonacid, mesic	Aeric Haplaquepts	Inceptisols.
Basher	Coarse-loamy, mixed, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Bath	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Braceville	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Buchanan	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols.
Chenango	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Chippewa	Fine-loamy, mixed, mesic	Typic Fragiaquepts	Inceptisols.
Dekalb	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Holly	Fine-loamy, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Kedron	Fine-loamy, mixed, mesic	Aquic Fragiudults	Ultisols.
Klinesville	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Lackawanna	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Leck Kill	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Linden	Coarse-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Lordstown	Coarse-loamy, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Mardin	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Meckesville	Fine-loamy, mixed, mesic	Typic Fragiudults	Ultisols.
Morris	Coarse-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Muck		Medihemists and Medifibrists	Histosols.
Oquaga	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.
Pocono	Loamy-skeletal, siliceous, mesic	Typic Hapludults	Ultisols.
Pope	Coarse-loamy, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Rexford	Coarse-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Shelmadine	Fine-loamy, mixed, mesic	Typic Fragiaquults	Ultisols.
Strip mine		Typic Udorthents	Entisols.
Volusia	Fine-loamy, mixed, mesic	Aeric Fragiaquepts	Inceptisols.
Wayland[1]	Fine-silty, mixed, nonacid, mesic	Mollic Fluvaquents	Entisols.
Weikert	Loamy-skeletal, mixed, mesic	Lithic Dystrochrepts	Inceptisols.
Wellsboro	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Wurtsboro[2]	Coarse-loamy, mixed, mesic	Typic Fragiochrepts	Inceptisols.
Wyoming	Loamy-skeletal, mixed, mesic	Typic Dystrochrepts	Inceptisols.

[1]The Wayland soils in this county are taxadjuncts to the Wayland series because they have a slightly thinner dark colored A horizon than is defined for the series.

[2]The Wurtzboro soils in this county are taxajuncts to the Wurtzboro series because they have a slightly lower chroma and value in the Bx horizon than is defined for the series.

used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name is the subgroup name preceded by a series of adjectives. The adjectives are the class names for texture and mineralogy, for example, that are used as family differentiae (see table 9). An example is the fine-loamy, nonacid, mesic, family of Typic Fluvaquents.

SERIES. The series consists of a group of soils that formed in a particular kind of parent material and that have genetic horizons that, except for the texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

General Nature of the County

The heritage of Luzerne County has been influenced by the early Indian inhabitants, as evidenced by the many place names of obvious Indian derivation. The Delawares and the Shawnees were perhaps the two most important Indian tribes, before the arrival of the early settlers during the mid to late 1700's. The Delaware Indians named the area "Wyoming," and the Susquehanna River Valley is still referred to as "Wyoming Valley."

Moravian missionaries first visited the area in 1742. Settlement began in 1753. In 1786 the county was formed from part of Northumberland County and was named for Chevalier de la Luzerne, French Minister to the United States. Constant Indian attacks, boundary and territorial disputes, and incidents relating to the American Revolution during the late 1770's slowed settlement and development in the county until the early 1800's.

The discovery of practical uses for anthracite coal during the early 1800's stimulated settlement and development in the county. The importance of coal and other industrial developments increased steadily until about the 1930's and 1940's, when other sources of energy caused a decline in coal use. During the late 1950's and early 1960's, local industrial development groups attracted many industries to the three major industrial areas: Wyoming Valley, the Mountain Top area, and the Hazleton area. The selection of industrial sites is

based primarily on topography and accessibility to transportation. Information on soil drainage and soil characteristics that affect engineering is valuable in the selection of industrial sites.

Luzerne County has a network of Federal and State highways and township roads. Interstate Highways 80 and 81 intersect in the south-central part of the county. Interstate 80 crosses Luzerne County from east to west and provides easy accessibility to New York City to the east and the important Great Lakes cities to the west. Interstate 81 crosses the county in a north-northeasterly direction and links Luzerne County with New York State to the north and Harrisburg to the south. U.S. Highway 11 parallels the Susquehanna River. The Northeast Extension of the Pennsylvania Turnpike crosses the eastern part of the county. Luzerne County has nearly 950 miles of State highways.

In addition to highways, there are several railroads in the county, which provide freight service to the major industrial areas. None of the railroads provides passenger service.

There are two commercial airports in the county. The largest, in the eastern part of the county near the Lackawanna county line, serves the metropolitan areas of Wilkes-Barre and Scranton. The other airport is near Hazleton, in the southern part of the county.

Farming

Farming accounts for only about 15 percent of the land area in the county and has had a less dominant role than industry in the general economy. The 1969 U.S. Census of Agriculture shows a decline in the number of farms and a general decline in most commodities produced on farms. In 1964 there were 919 farms in the county, but by 1969 the number had declined to 607. The average size of a farm increased from 108.0 acres in 1964 to 124.6 acres in 1969. This increase in size appears to be a nationwide trend.

According to the Census of Agriculture, harvested acres of most major farm crops declined substantially from 1964 to 1969. The two exceptions were corn for grain, which increased from 3,296 acres harvested in 1964 to 4,372 acres in 1969, and barley for grain, which increased from 99 acres harvested in 1964 to 228 acres in 1969. The acreage of five major farm crops commonly grown in the county declined more than 30 percent from 1964 to 1969. The acreage in harvested vegetables declined an average 21 percent. Tomatoes showed the largest reduction; 553 acres was harvested in 1964 and 243 acres in 1969. The acreage in harvested vegetables may show even more substantial reductions in the future because some nearby canneries have closed since the 1969 census.

Climate[7]

Luzerne County is in the east-central part of Pennsylvania. The terrain is generally hilly, and the ridges and valleys are oriented northeast to southwest. The elevation ranges from about 2,300 feet in the northwest corner of the county to 550 feet along the Susquehanna River. It is 2,000 feet near the southern border of the county.

Luzerne County is in the path of air masses that originate in western and central Canada. These air masses interact with the warm air from the Gulf of Mexico to produce generous precipitation throughout the year. The higher elevations receive additional precipitation because of upslope motion.

Summers are generally warm, and maximum temperatures average in the low to mid 80's. Occasional higher temperatures occur when warm air moves into the area from the southwest. Precipitation in summer is generally showers and thunderstorms. Heavy rainfall associated with tropical storms and hurricanes moving up the coast occasionally reaches Luzerne County.

Winter is characterized by cold temperatures and cloudy skies. Daytime temperatures average in the mid to upper 30's at the lower elevations. Higher elevations may have freezing temperatures on 150 days of the year. On 50 of these days the maximum temperature may be at or below freezing. Winter precipitation is light but frequent. The lower elevations receive most precipitation in the form of rain, whereas the higher elevations receive most in the form of snow. Annual snowfall ranges from about 15 inches at the lower elevation to more than 70 inches at the higher elevations.

Spring and fall are characterized by rapidly changing weather patterns. Alternate periods of freezing and thawing are common during both seasons. The length of the growing season at the lower elevations can range from 120 to 200 days, whereas at the higher elevations it can range from 120 to 180 days.

Climatological data for the county is summarized in tables 10 and 11.

Drainage, Physiography, and Geology[8]

Luzerne County has two major watersheds. About 80 percent of the county is within the Susquehanna River watershed. The Lehigh River watershed drains about 20 percent of the eastern part of the county.

Luzerne County is in two physiographic provinces. The southern three-fourths of the county is within the Valley and Ridge province, and the northern one-fourth is within the Appalachian Plateau province. The topography of the Valley and Ridge province is a series of northeast-southwest trending mountains and valleys. The rolling to nearly level plateau is dissected by moderately deep valleys.

Rocks exposed in the county range in age from Devonian, the oldest, to Pennsylvanian, the youngest. Table 12 shows the age relationship of the geology.

All of Luzerne County has been glaciated at least once. Sand and gravel deposited by glacial streams is in most of the valleys. Glacial lake deposits are also in many valleys.

Some knowledge of the geology of Luzerne County is basic to the development and use of this resource. Topographic and geologic surveys, studies, and reports

[7]Prepared by National Climatic Center.

[8]Prepared by LOUIS KIRKALDIE, geologist, Soil Conservation Service.

TABLE 10.—*Temperature and precipitation data*

[Temperature data from Wilkes-Barre-Scranton Airport. Precipitation from Wilkes-Barre 4 NE]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total precipitation	One year in 10 will have—		Days with snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F	°F	°F	°F	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	33.5	18.4	49	1	2.12	0.79	3.42	16	4
February	35.3	19.3	50	4	2.16	1.25	3.59	14	5
March	44.7	27.2	65	13	2.66	1.88	3.47	7	3
April	58.9	38.0	78	27	3.27	1.65	4.83	1	2
May	70.0	47.8	85	36	3.83	1.66	5.73	(1)	0
June	79.0	56.8	90	47	3.49	1.74	5.60	0	0
July	83.0	61.3	92	52	4.11	1.86	6.43	0	0
August	80.7	59.2	91	49	4.11	1.94	6.78	0	0
September	73.6	52.1	87	39	3.06	1.09	4.80	0	0
October	63.0	42.2	78	31	2.87	1.54	4.90	(1)	0
November	48.8	32.8	65	21	3.19	1.62	4.61	1	2
December	36.1	22.0	54	7	2.84	.90	4.80	11	3
Year	58.9	39.8	[2]95	[3]−5	37.71	30.12	43.59	50	4

[1]Less than 0.5 day. [2]Average annual maximum. [3]Average annual minimum.

TABLE 11.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data from Wilkes-Barre-Scranton Airport]

Probability	Dates for given probability and temperature				
	16°F or lower	20°F or lower	24°F or lower	28°F or lower	32°F or lower
Spring:					
1 year in 10 later than	Mar. 26	Apr. 5	Apr. 12	Apr. 25	May 12
2 years in 10 later than	Mar. 21	Mar. 31	Apr. 8	Apr. 21	May 6
5 years in 10 later than	Mar. 10	Mar. 21	Mar. 30	Apr. 13	Apr. 25
Fall:					
1 year in 10 earlier than	Nov. 22	Nov. 13	Oct. 31	Oct. 9	Sept. 27
2 years in 10 earlier than	Nov. 26	Nov. 18	Nov. 5	Oct. 15	Oct. 3
5 years in 10 earlier than	Dec. 5	Nov. 27	Nov. 15	Oct. 26	Oct. 14

TABLE 12.—*Relative ages of geologic formations or groups*

Age	Formation or group	Predominant rock type
Pennsylvanian.	Post-Pottsville Group	Sandstone and shales and some conglomerates and numerous mineable coals.
	Pottsville Group	Sandstone and conglomerates and some mineable coals.
Mississippian.	Mauch Chunk Formation	Red shales and brown to greenish gray sandstones.
	Pocono Group	Conglomerates and sandstones.
Devonian.	Susquehanna Group:	
	(1) Catskill Formation	Chiefly red to brownish shales and sandstones.
	(2) Marine beds	Gray to olive brown shales and sandstone.
	Hamilton Group and Onondaga beds.	Brown, olive, and black shales and sandstones.

provide essential information to engineers, builders, well drillers, miners, developers, and others. Geology determines where sources of ground water, minerals, oil, gas, and ores can be found. Detailed geologic investigations are needed to design large dams, buildings, and highways.

The principal mineral resources in Luzerne County are anthracite coal, sand and gravel, and some building stone. Anthracite coal is mined extensively from the Post-Pottsville and Pottsville Groups throughout the Wyoming Valley and Hazleton areas. Sand and gravel deposits are on terraces along the Susquehanna River and along several of its major tributary streams. Some shales of the Mauch Chunk Formation are used as raw material in the manufacture of brick. Building stone

is quarried to a very limited extent. Most of the formations are a source of material for crushed stone for road construction.

Water Supply[9]

Water supply in Luzerne County varies, but it is generally adequate to meet the county's needs. Most of the water needs for the densely populated sections of the county are met by surface sources. Several large water reservoirs throughout the county supply water to the communities along the Susquehanna River and the city of Hazleton.

Drilled wells are the major source of water for the smaller communities in outlying areas of the county and in the rural farm and nonfarm areas. Table 13 shows median depth and estimated yield of water by geologic formation and group.

Literature Cited

(1) ALLAN, P. F., L. E. GARLAND, AND R. DUGAN.
1963. RATING NORTHEASTERN SOILS FOR THEIR SUITABILITY FOR WILDLIFE HABITAT. 28th North Am. Wildl. Nat. Resour. Conf. Wildl. Manage. Inst., pp. 247-261, illus.

(2) AMERICAN ASSOCIATION OF STATE HIGHWAY [AND TRANSPORTATION] OFFICIALS.
1970. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 10, 2 vol., illus.

(3) AMERICAN SOCIETY FOR TESTING AND MATERIALS.
1974. METHOD FOR CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(4) FERGUSON, ROLAND H.
1968. THE TIMBER RESOURCES OF PENNSYLVANIA, U.S. FOREST SERV. Resour. Bull. NE-8, 147 pp., illus.

(5) MCCARTHY, EDWARD FLORINCE.
1933. YELLOW-POPLAR CHARACTERISTICS, GROWTH AND MANAGEMENT. U.S. Dep. Agric. Tech. Bull. 356, 58 pp., illus.

(6) SCHNUR, G. LUTHER.
1937. YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FOREST. U.S. Dep. Agric. Tech. Bull. 560, 88 pp., illus. [Reprinted 1961.]

(7) SIMONSON, ROY W.
1968. SOIL CORRELATION AND THE NEW CLASSIFICATION SYSTEM. Soil Sci. 96: 23-30.

(8) UNITED STATES DEPARTMENT OF AGRICULTURE.
1951. SOIL SURVEY MANUAL. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(9) UNITED STATES DEPARTMENT OF AGRICULTURE.
1960. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. Soil Conserv. Serv., 265 pp., illus. [Supplements issued March 1967, September 1968, April 1969.]

(10) UNITED STATES DEPARTMENT OF AGRICULTURE.
1968. THE PENNSYLVANIA SOIL AND WATER CONSERVATION NEEDS INVENTORY. Soil Conserv. Serv., 257 pp., illus.

(11) UNITED STATES DEPARTMENT OF COMMERCE.
1972. GENERAL SOCIAL AND ECONOMIC CHARACTERISTICS, PENNSYLVANIA. 441 pp. 289-780.

[9]Prepared from personal communications with EVAN T. SHUSTER, geologist, Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geological Survey.

TABLE 13.—*Median depth and estimated yield of water*

Geologic units yielding water	Median range in depth of wells	Estimated average yield
	Feet	*Gal/min*
Post-Pottsville Group	140	25
Pottsville Group	140	25
Mauch Chunk Formation	180	10–15
Pocono Group	140	30
Susquehanna Group	290	45
Hamilton Group	290	45

Glossary

Acidity. See Reaction, soil.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock, depth.
(a) Shallow: Less than 20 inches to solid bedrock.
(b) Moderately deep: 20 to 40 inches to solid bedrock.
(c) Deep: 40 inches or more to solid bedrock.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hyrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is com-

monly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Erosion. The wearing away of land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over the long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Leaching. The removal of soluble material from soil or other material by percolating water.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0 inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches).

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PENNSYLVANIA STATE UNIVERSITY COLLEGE OF AGRICULTURE,
AND THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
STATE CONSERVATION COMMISSION

GENERAL SOIL MAP

LUZERNE COUNTY, PENNSYLVANIA

Scale 1:253,440
1 0 1 2 3 4 Miles
1 0 1 2 3 4 Kilometers

N

WYOMING COUNTY
SULLIVAN COUNTY
COLUMBIA COUNTY
SCHUYLKILL COUNTY
CARBON COUNTY
MONROE COUNTY
LACKAWANNA COUNTY
SUSQUEHANNA RIVER
DELAWARE AND HUDSON
CONRAIL
41°20′
41°10′
41°00′
76°10′
75°50′
76°00′

FRANKLIN
DALLAS
EXETER
LAKE
ROSS
LEHMAN
JACKSON
KINGSTON
PITTSTON
PLAINS
JENKINS
FAIRMOUNT
PLYMOUTH
HUNLOCK
HANOVER
WILKES-BARRE
UNION
HUNTINGTON
NEWPORT
BEAR CREEK
BUCK
SLOCUM
RICE
FAIRVIEW
WRIGHT
SALEM
DORRANCE
DENNISON
HOLLENBACK
NESCOPECK
BUTLER
FOSTER
SUGARLOAF
BLACK CREEK
HAZLE

Harvey's Lake
Lake Jean
Huntsville Reservoir
Pike's Creek Reservoir
Meadow Run Pond
Crystal Lake
Penn Lake
Francis E Walter Reservoir
Swoyersville
Forty Fort
Luzerne
Kingston
Plymouth
Nanticoke
West Hazleton
Hazleton
West Pittston
Pittston
White Haven

SOIL ASSOCIATIONS

1 — Oquaga-Wellsboro-Lackawanna association: Gently sloping to very steep, moderately deep and deep, well drained and moderately well drained soils on dissected plateaus

2 — Oquaga-Lordstown-Arnot association: Moderately steep to very steep, moderately deep and shallow, well drained soils on mountain ridges and mountainsides

3 — Strip mine-Mine dump association: Nearly level to very steep, deep and very shallow soil and rock material on mountaintops in valleys

4 — Chenango-Pope-Wyoming association: Nearly level to very steep, deep, well drained and somewhat excessively drained soils on glacial outwash terraces and on flood plains

5 — Pocono-Dekalb association: Gently sloping to very steep, deep and moderately deep, well drained soils on mountaintops and ridges

6 — Lordstown-Mardin-Volusia association: Gently sloping to very steep, deep and moderately deep, well drained to somewhat poorly drained soils on dissected plateaus

7 — Meckesville-Kedron-Leck Kill association: Gently sloping to moderately steep, deep, well drained and moderately well drained soils in upland valleys

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

Compiled 1979

INDEX TO MAP SHEETS

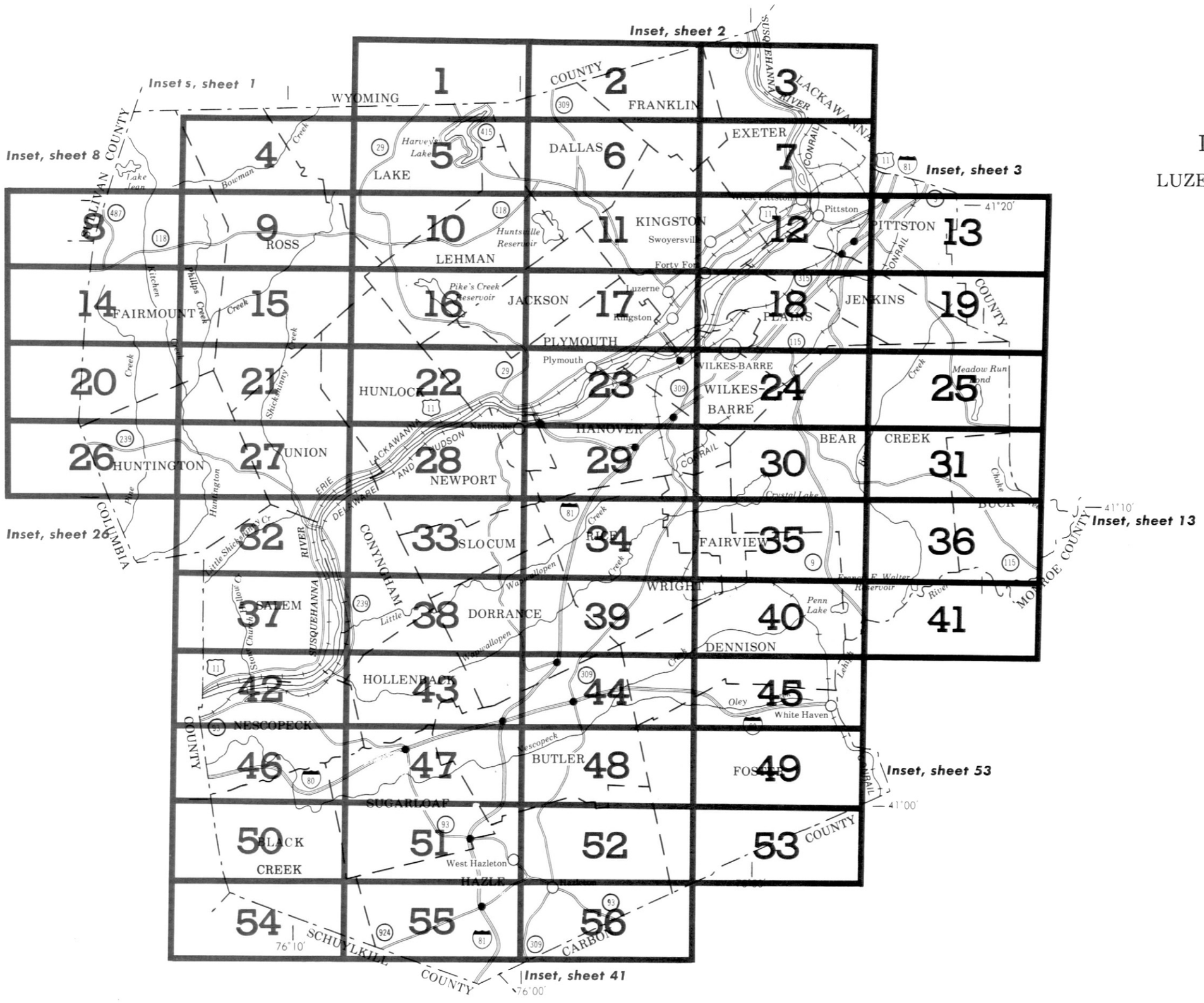
LUZERNE COUNTY, PENNSYLVANIA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 1 2 3 4 Kilometers

N



SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second is usually a small letter but it is a capital letter if the unit is broadly defined. The third letter, A, B, C, D, or F shows the slope class. Most symbols without a slope letter are for nearly level soils, but some are for miscellaneous land types.

SYMBOL	NAME
Ag	Alluvial land
AlB	Alvira silt loam, 3 to 8 percent slopes
AnB	Alvira very stony silt loam, 0 to 8 percent slopes
ArB	Arnot-Rock outcrop complex, 0 to 8 percent slopes
ArD	Arnot-Rock outcrop complex, 8 to 25 percent slopes
ASF*	Arnot-Rock outcrop complex, steep
At	Atherton silt loam, gray subsoil variant
Bf	Basher soils
BkB	Bath channery silt loam, 3 to 8 percent slopes
BkC	Bath channery silt loam, 8 to 15 percent slopes
BkD	Bath channery silt loam, 15 to 25 percent slopes
BnB	Bath very stony silt loam, 3 to 8 percent slopes
BnD	Bath very stony silt loam, 8 to 25 percent slopes
BrA	Braceville gravelly loam, 0 to 3 percent slopes
BrB	Braceville gravelly loam, 3 to 8 percent slopes
BrC	Braceville gravelly loam, 8 to 15 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
BxB	Buchanan extremely stony loam, 3 to 8 percent slopes
BxD	Buchanan extremely stony loam, 8 to 25 percent slopes
ChA	Chenango gravelly loam, 0 to 3 percent slopes
ChB	Chenango gravelly loam, 3 to 8 percent slopes
ChC	Chenango gravelly loam, 8 to 15 percent slopes
ClA	Chippewa silt loam, 0 to 3 percent slopes
ClB	Chippewa silt loam, 3 to 8 percent slopes
CnB	Chippewa very stony silt loam, 0 to 8 percent slopes
DdB	Dekalb extremely stony sandy loam, 0 to 8 percent slopes
DdD	Dekalb extremely stony sandy loam, 8 to 25 percent slopes
DEF*	Dekalb extremely stony sandy loam, steep
Ho	Holly silt loam
KdB	Kedron channery silt loam, 3 to 8 percent slopes
KdC	Kedron channery silt loam, 8 to 15 percent slopes
KeB	Kedron very stony silt loam, 3 to 8 percent slopes
KeC	Kedron very stony silt loam, 8 to 20 percent slopes
KwB	Kedron channery silt loam, somewhat poorly drained, 0 to 8 percent slopes
KxB	Kedron very stony silt loam, somewhat poorly drained, 0 to 8 percent slopes
LaB	Lackawanna channery silt loam, 3 to 8 percent slopes
LaC	Lackawanna channery silt loam, 8 to 15 percent slopes
LaD	Lackawanna channery silt loam, 15 to 25 percent slopes
LcB	Lackawanna very stony silt loam, 3 to 8 percent slopes
LcD	Lackawanna very stony silt loam, 8 to 25 percent slopes
LEF*	Lackawanna and Bath very stony silt loam, steep
LkB	Leck Kill channery silt loam, 3 to 8 percent slopes
LkC	Leck Kill channery silt loam, 8 to 15 percent slopes
LkD	Leck Kill Channery silt loam, 15 to 25 percent slopes
Ln	Linden soils
MaB	Mardin channery silt loam, 3 to 8 percent slopes
MaC	Mardin channery silt loam, 8 to 15 percent slopes
MaD	Mardin channery silt loam, 15 to 25 percent slopes
McB	Mardin very stony silt loam, 3 to 8 percent slopes
McD	Mardin very stony silt loam, 8 to 25 percent slopes
MeB	Meckesville channery silt loam, 3 to 8 percent slopes
MeC	Meckesville channery silt loam, 8 to 15 percent slopes
MeD	Meckesville channery silt loam, 15 to 25 percent slopes
MfB	Meckesville very stony silt loam, 3 to 8 percent slopes
MfD	Meckesville very stony loam, 8 to 25 percent slopes
Mg	Mine dump
Mh	Mine dump, burned
Mm	Mine wash
MoB	Morris channery silt loam, 0 to 8 percent slopes
MoC	Morris channery silt loam, 8 to 15 percent slopes
MsB	Morris very stony silt loam, 0 to 8 percent slopes
MsC	Morris very stony silt loam, 8 to 15 percent slopes
Mu	Muck
OlB	Oquaga and Lordstown channery silt loams, 3 to 8 percent slopes
OlC	Oquaga and Lordstown channery silt loams, 8 to 15 percent slopes
OlD	Oquaga and Lordstown channery silt loams, 15 to 25 percent slopes
OpB	Oquaga and Lordstown extremely stony silt loams, 3 to 8 percent slopes
OpD	Oquaga and Lordstown extremely stony silt loams, 8 to 25 percent slopes
OXF*	Oquaga and Lordstown extremely stony silt loams, steep
PoB	Pocono gravelly sandy loam, 3 to 8 percent slopes
PoC	Pocono gravelly sandy loam, 8 to 15 percent slopes
PpB	Pocono extremely stony sandy loam, 3 to 8 percent slopes
PpD	Pocono extremely stony sandy loam, 8 to 25 percent slopes
Ps	Pope soils
RdA	Rexford loam, 0 to 3 percent slopes
RdB	Rexford loam, 3 to 8 percent slopes
ShA	Shelmadine silt loam, 0 to 5 percent slopes
SkB	Shelmadine very stony silt loam, 0 to 5 percent slopes
Sm	Strip mine
Ub	Urban land
Uf	Urban land, rarely flooded
VoB	Volusia channery silt loam, 0 to 8 percent slopes
VoC	Volusia channery silt loam, 8 to 15 percent slopes
VrB	Volusia very stony silt loam, 0 to 8 percent slopes
VrC	Volusia very stony silt loam, 8 to 15 percent slopes
Wa	Wayland silt loam
WeB	Weikert and Klinesville channery silt loams, 3 to 8 percent slopes
WeC	Weikert and Klinesville channery silt loams, 8 to 15 percent slopes
WeD	Weikert and Klinesville channery silt loams, 15 to 25 percent slopes
WlB	Wellsboro channery silt loam, 3 to 8 percent slopes
WlC	Wellsboro channery silt loam, 8 to 15 percent slopes
WlD	Wellsboro channery silt loam, 15 to 25 percent slopes
WmB	Wellsboro very stony silt loam, 3 to 8 percent slopes
WmD	Wellsboro very stony silt loam, 8 to 25 percent slopes
WrB	Wurtsboro channery loam, 3 to 8 percent slopes
WrC	Wurtsboro channery loam, 8 to 15 percent slopes
WrD	Wurtsboro channery loam, 15 to 25 percent slopes
WtB	Wurtsboro extremely stony loam, 3 to 8 percent slopes
WtD	Wurtsboro extremely stony loam, 8 to 25 percent slopes
WyD	Wyoming gravelly loam, 15 to 25 percent slopes
WyF	Wyoming gravelly loam, 25 to 60 percent slopes

* The composition of these units is more variable than that of other units in the survey area but has been controlled well enough for interpretations to be made for the expected uses of the soils.

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oil field, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPELINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

(CeA; FoB2)

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

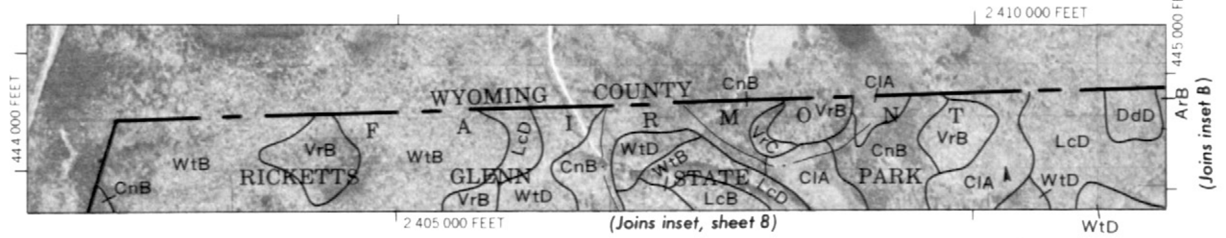
MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy Spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot (0)

1

N

INSET A



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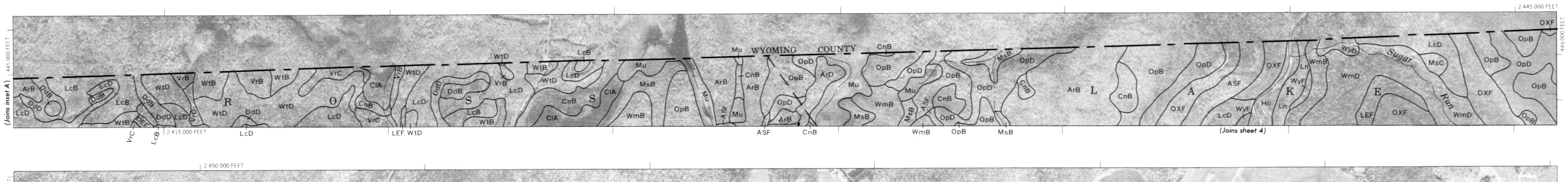
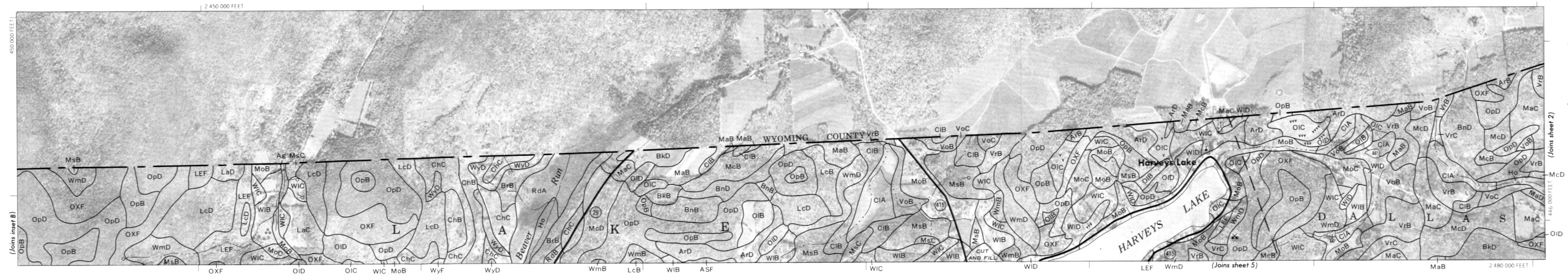
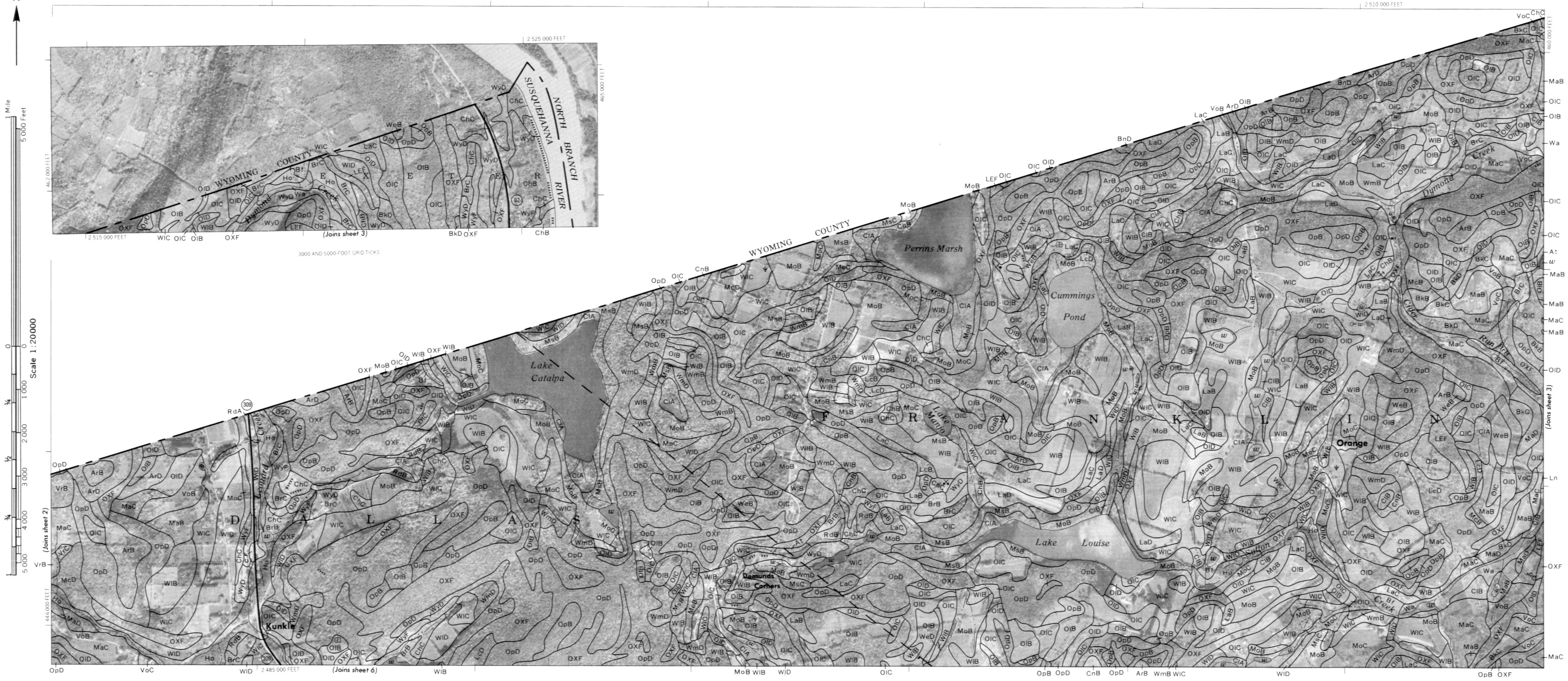




Scale 1:20000

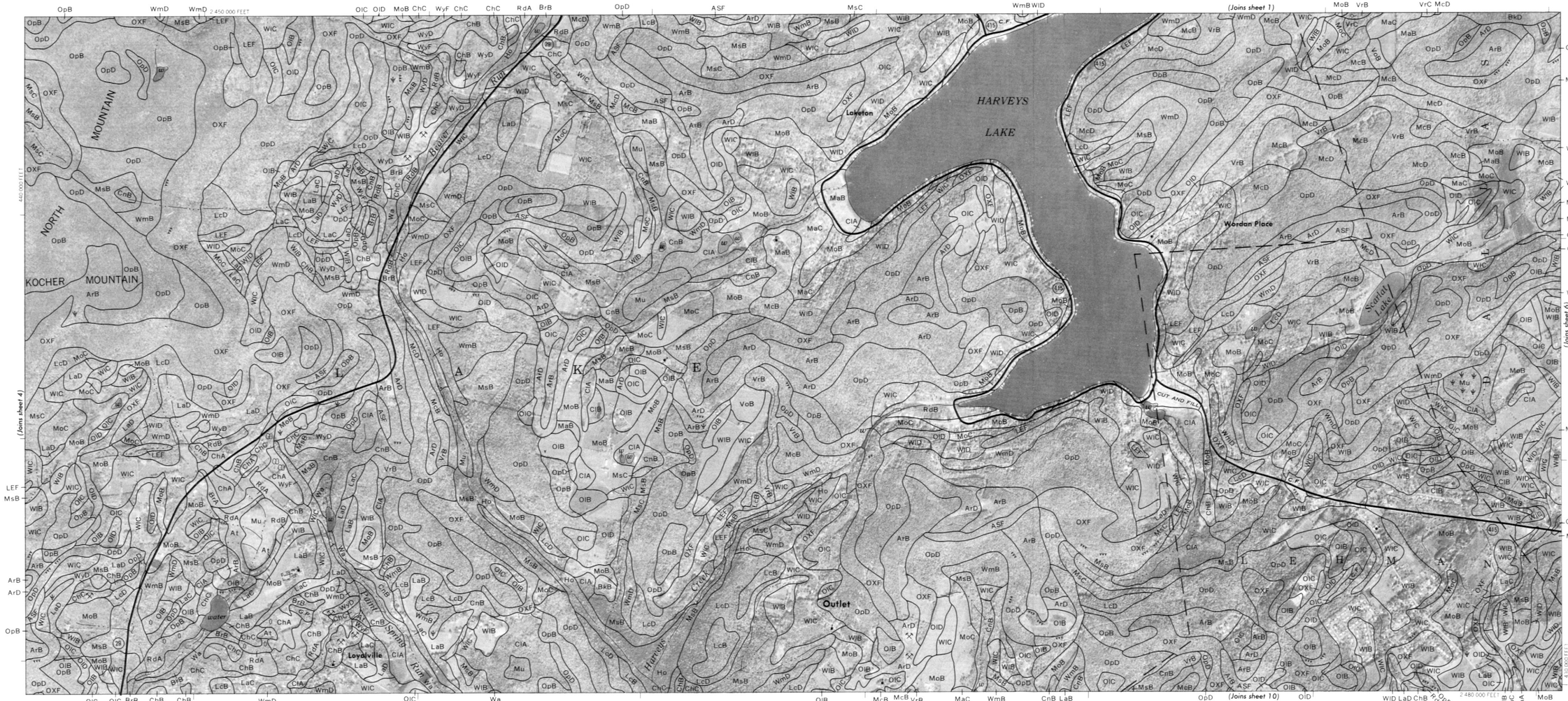
1 Mile

5 000 Feet


2
N
Scale 1:20000
1 Mile
5 000 Feet
WYOMING COUNTY
SUSQUEHANNA
NORTH BRANCH
RIVER
EXETER
Dymond Creek
(Joins sheet 3)
3000 AND 5000-FOOT GRID TICKS
2 525 000 FEET
2 515 000 FEET
2 510 000 FEET
2 485 000 FEET
465 000 FEET
460 000 FEET
446 000 FEET
Perrins Marsh
Cummings Pond
Lake Catalpa
Lake Louise
DALLAS
FRANKLIN
Orange
Kunkle
Dymonds Corners
Leonard Creek
Sutton Creek
Dymond Creek
(Joins sheet 2)
(Joins sheet 3)
(Joins sheet 6)

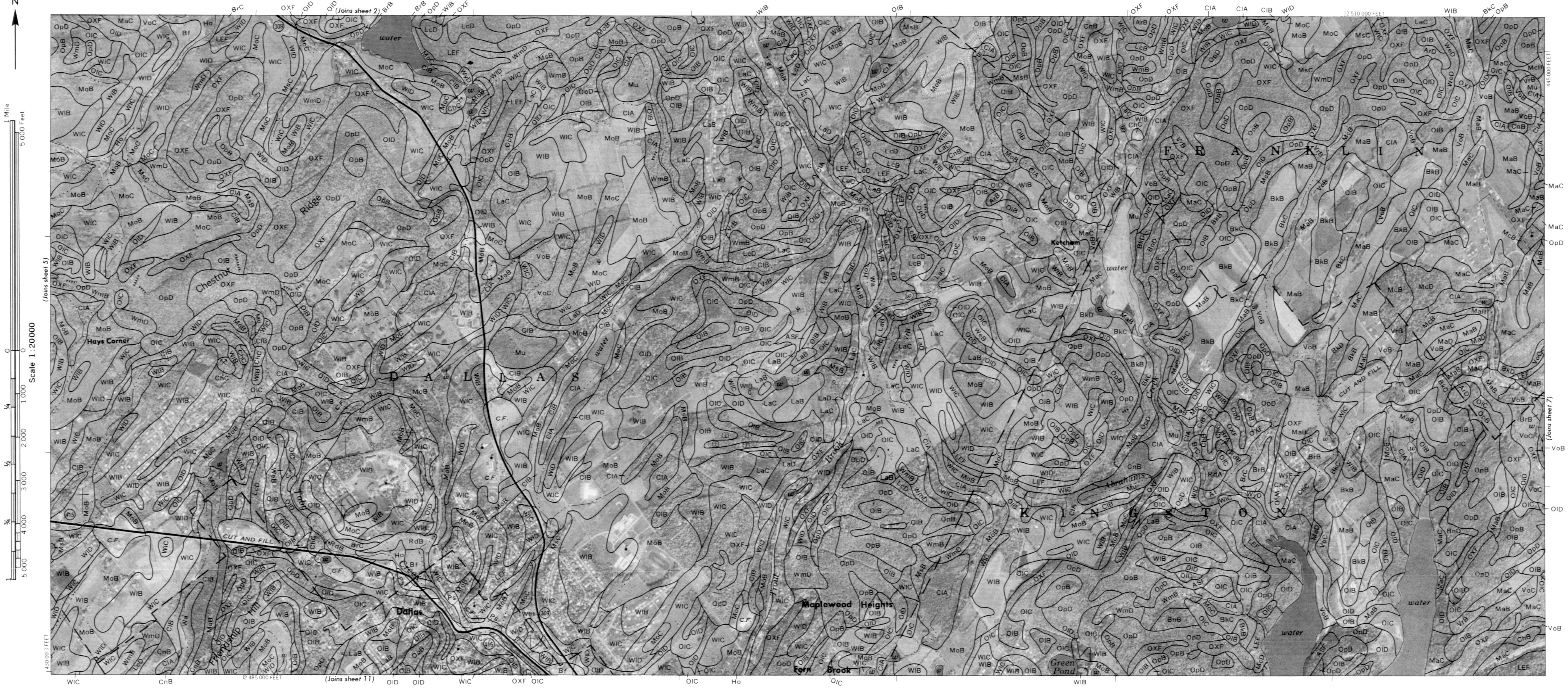
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 4

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 5



6

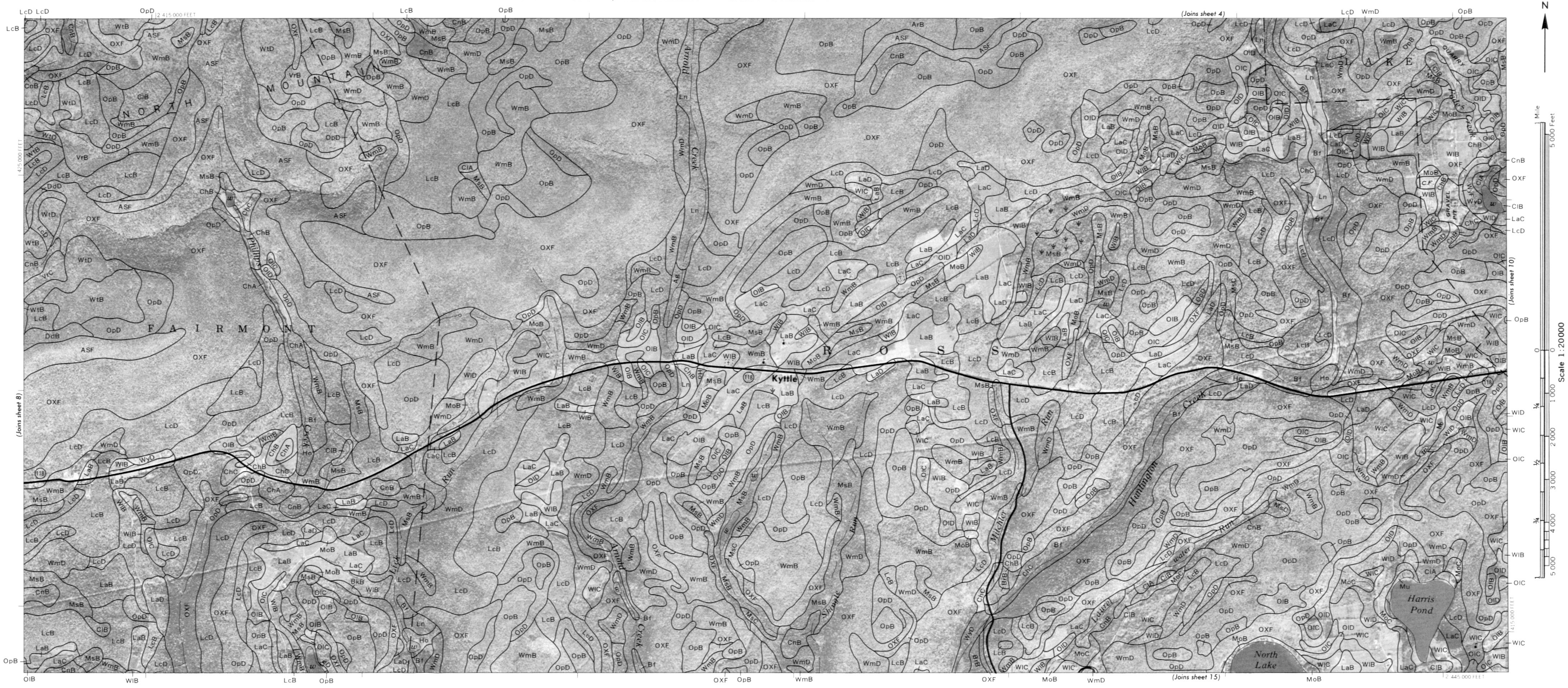
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 6



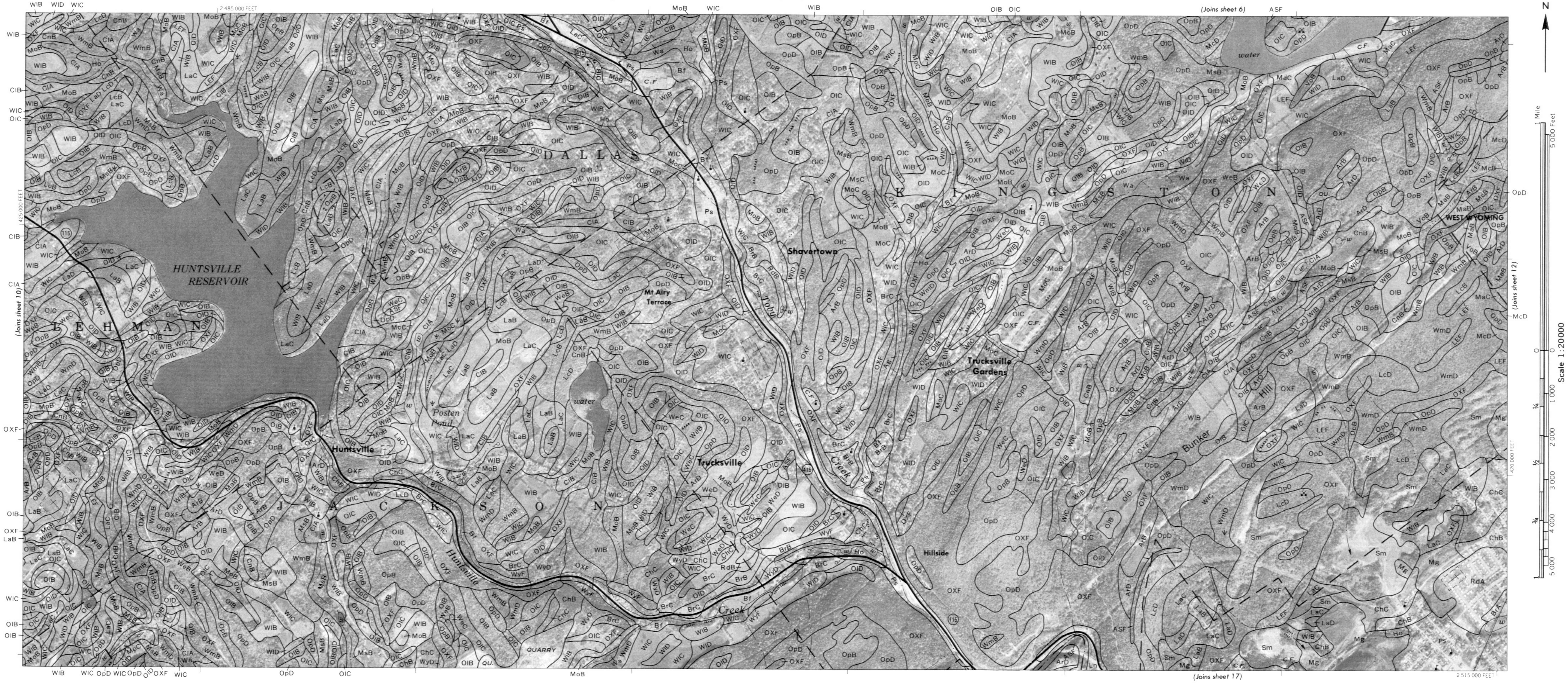
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.


FRANKLIN
EXETER
KINGSTON
Carverton
Meeker
Harding
Campbell Ledge
CAMPBELLS LEDGE DAM
PETERSON MOUNTAIN
SUSQUEHANNA RIVER
LACKAWANNA RIVER
Scovell Island
Pittston Junction
Upper Pittston
DURYEA
LACKAWANNA COUNTY
GRAVEL PIT
CUT AND FILL
Hicks Creek
Hendricks Creek
CONRAIL
(Joins sheet 3)
(Joins sheet 6)
(Joins sheet 12)
(Joins inset, sheet 3)
2 515 000 FEET
2 545 000 FEET
44 1 000 FEET
43 1 000 FEET
N
Mile
5 000 Feet
Scale 1:20000


8
N
Mile
5,000 Feet
Scale 1:20000
(Joins inset A, sheet 1)
(Joins inset)
(Joins sheet 4)
(Joins sheet 9)
(Joins upper right)
(Joins sheet 14)
SULLIVAN COUNTY
FALKMONT
NORTH MOUNTAIN
FAIRMONT
RICKETTS GLENN STATE PARK
Lake Jean
Lake Rose
Opperman Pass
Cherry Ridge
Cherry Run
Lake Leigh
Glen Leigh
Ganoga Glen
Kitchen Creek
Maple Run
Spring Brook
Shingle Cabin Branch
South Branch Huntington Creek
Kitchen Creek Falls
water
2 410 000 FEET
2 400 000 FEET
2 395 000 FEET
415 000 FEET
420 000 FEET
425 000 FEET
430 000 FEET


9
N
N O R T H
M O U N T A I N
F A I R M O N T
R O S S
L A K E
Kyttle
Arnold Creek
Phillips Creek
Lick Run
Huntington Creek
Mitchler Run
Harris Pond
North Lake
(Joins sheet 4)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 15)
Scale 1:20000
1 Mile
5 000 Feet

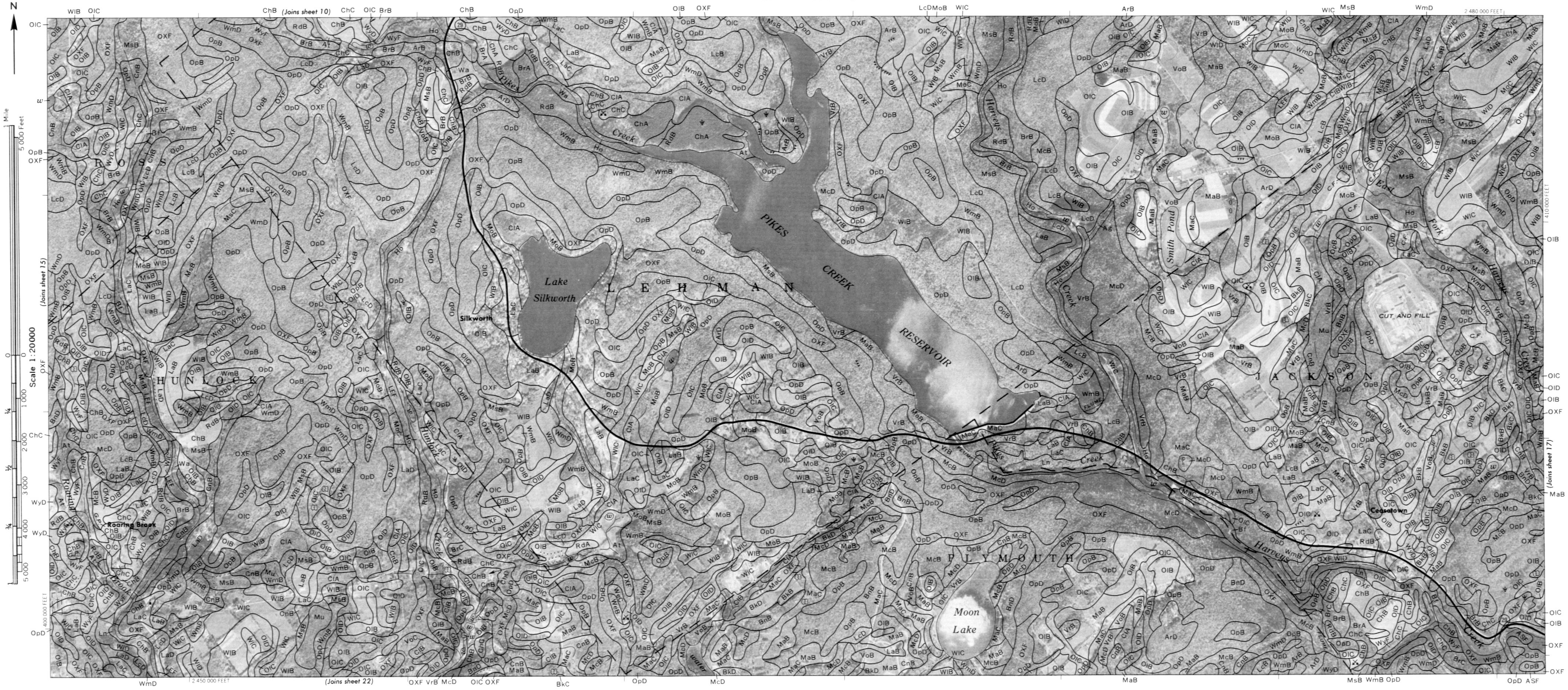

10
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 10
N
Scale 1:20000
1 Mile
5,000 Feet
(Joins sheet 5)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 16)
2 480 000 FEET
2 450 000 FEET
425 000 FEET
L A K E
L E H M A N
R O S S
Pikes Creek
Fades Creek
Harvey Run
Brittany Pond
Simms Pond
Meeker
Lehman


11
N
(Joins sheet 6)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 17)
2 485 000 FEET
2 515 000 FEET
425 000 FEET
420 000 FEET
HUNTSVILLE RESERVOIR
DALLAS
LEHMAN
JACKSON
KINGSTON
Shavertown
Mt Airy Terrace
Trucksville Gardens
Trucksville
Huntsville
Posten Pond
Hillside
Bunker Hill
WEST WYOMING
Huntsville Creek
Toby Creek
QUARRY
water
Scale 1:20000
Mile
5 000 Feet

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 12


N
Scale 1:20000
1 Mile
5 000 Feet
(Joins sheet 9)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 21)
12 415 000 FEET
12 410 000
12 445 000 FEET
12 440 000 FEET
F A I R M O N T
R O S S
H U N L O C K
UNION
Sweet Valley
North Lake
Grassy Pond
Sylvan Lake
Blaine Pond
Bear Swamp
Rittenhouse
Pritchard
Phillips
Huntington
Creek
Marsh
Hollow
Nevel
GRAVEL PIT

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 16



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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N
Mile
Scale 1:20000
5 000 Feet

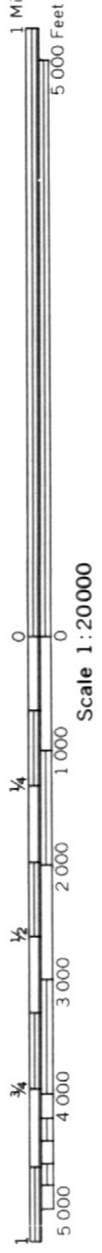

(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 24)
FORTY FORT
Plainsville
Hilldale
Laflin
J E N K I N S
Culver Island
RIVER
SUSQUEHANNA
NORTH BRANCH
QUARRY
CUT AND FILL
Port Bowkley
PLAINS
Hudson
Ridgewood
Keystone
Westminster
Lampblack
Gardner Creek
Gardner Creek Reservoir
P L A I N S
Midvale
KINGSTON
GRAVEL PIT
Miners Mills
Fox Hill
Parsons
Laurel Run
Mill Creek
Mill Creek Reservoir
Deep Hollow Pond
Deep Creek
PENNSYLVANIA TURNPIKE NORTHEAST EXTENSION
WILKES BARRE
B E A R C R E E K

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 19

(20)

N

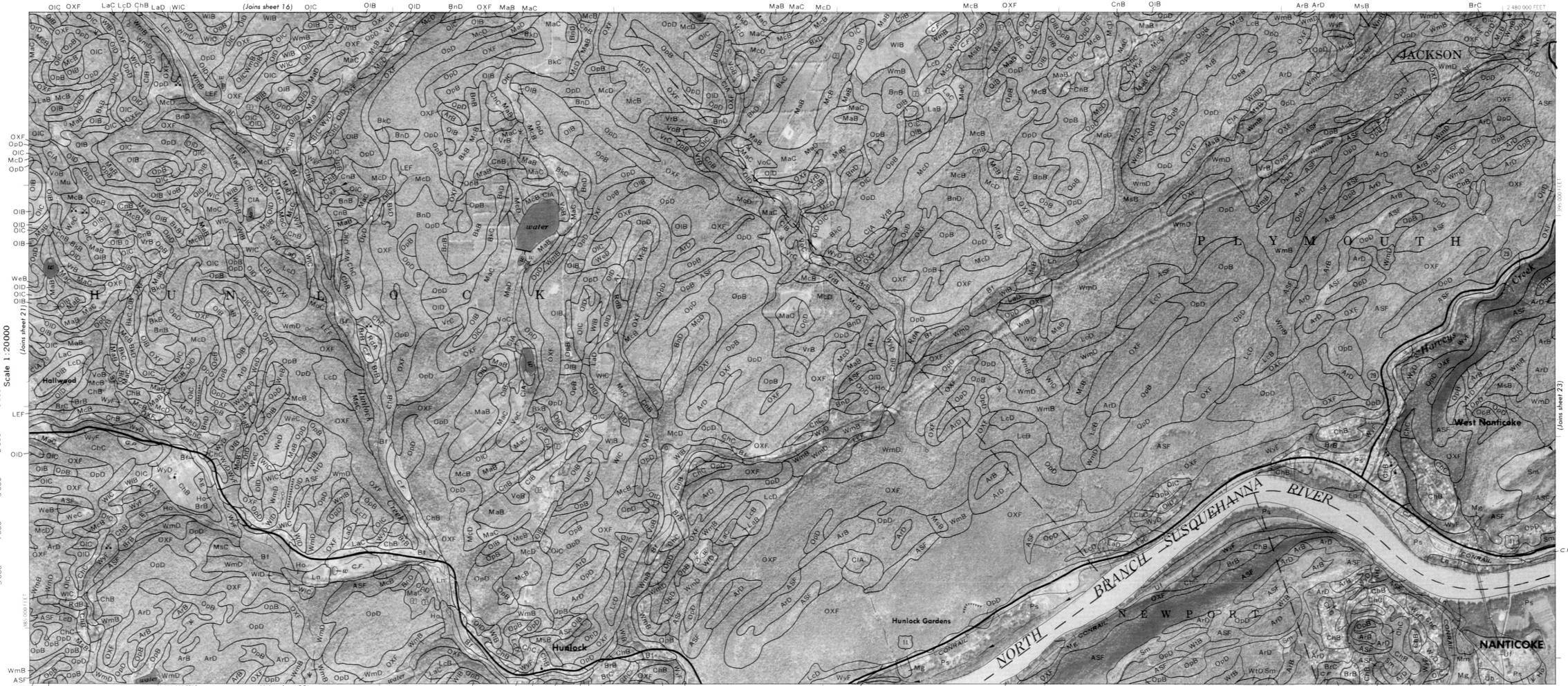
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 20



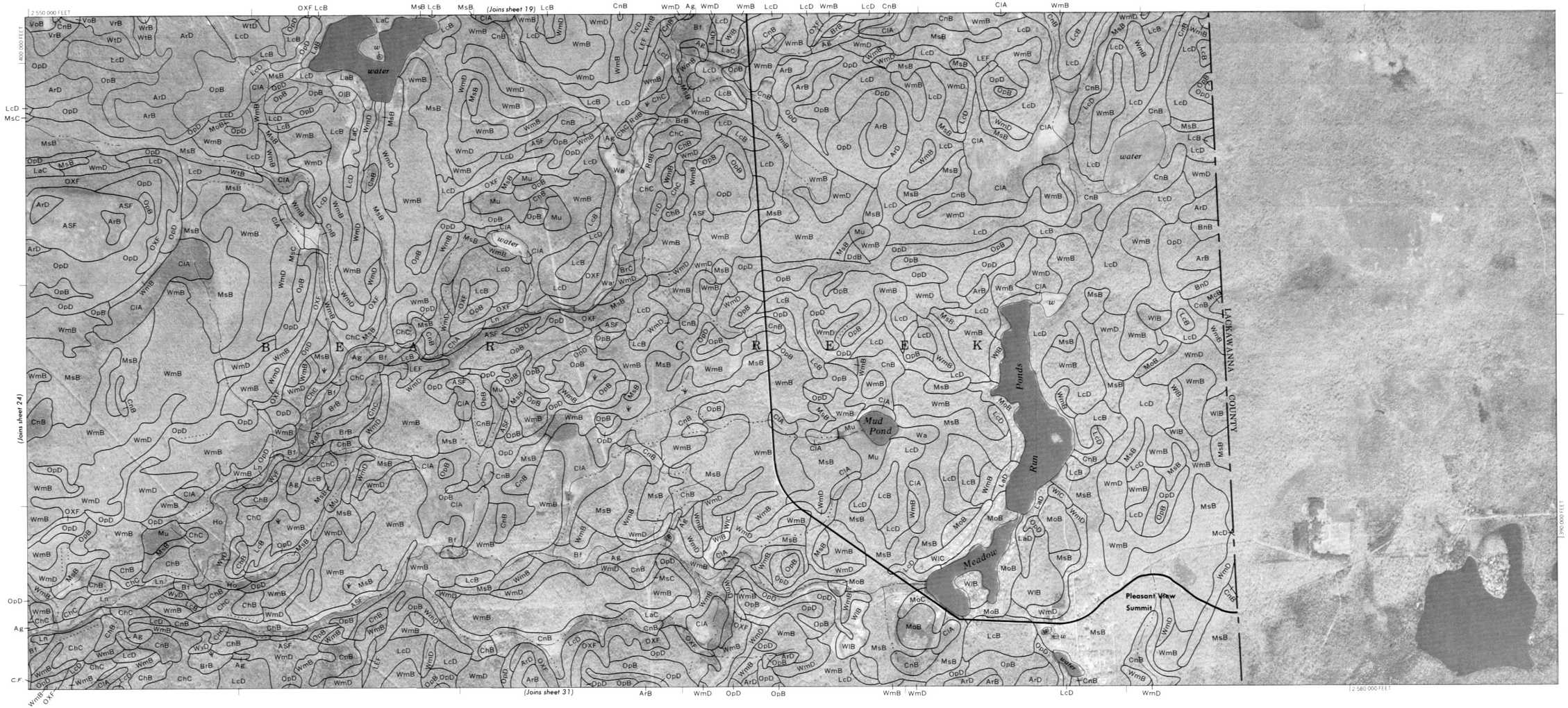
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

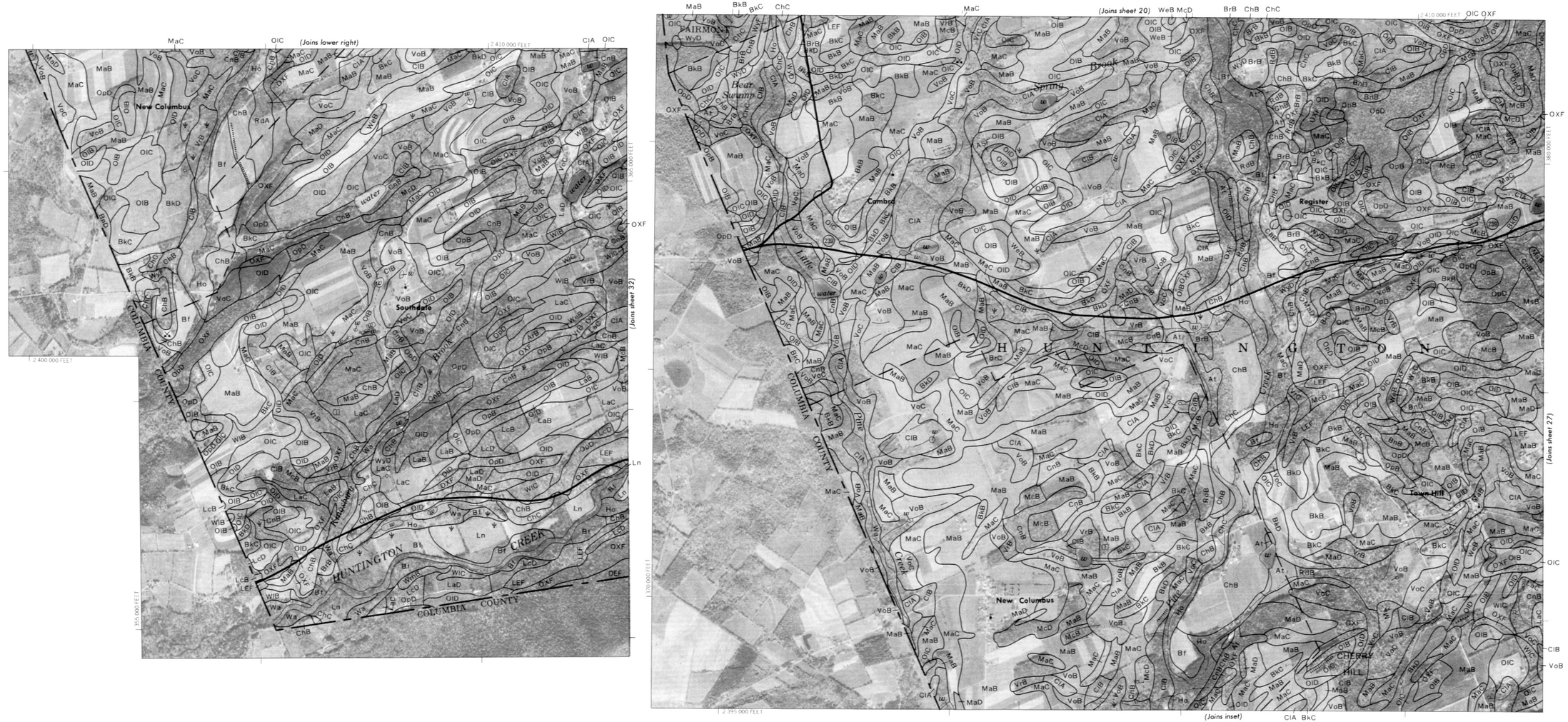

N
Scale 1:20000
Mile
5,000 feet
FAIRMONT
ROSS
HUNLOCK
HUNTINGTON
UNION
Patterson Grove
Bloomingdale
Muhlenburg
Harveyville
Broadway
Hillard Lake
Silver Lake
Shickshinny Lake
Osburn Culver Pond
Shickshinny Creek
Huntington Creek
Mausers Creek
Rogers Creek
Joins sheet 20
Joins sheet 22
Joins sheet 15
Joins sheet 27

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 22




(Joins sheet 18)
WILKES BARRE
Boulevard Manor
Mountain Park
Georgetown
Laurel Run
Oliver Mills
Lleweliyn Corners
WILKES-BARRE MOUNTAIN
PLAINS
BEAR CREEK MOUNTAIN
WOMELSDORF
EXTENSION
NORTHEAST
CONRAIL
CUT AND FILL
C.F.
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 30)
2 545 000 FEET
2 520 000 FEET
400 000 FEET
980 000 FEET
Scale 1:20000
Mile
5 000 Feet


BEAR CREEK
Mud Pond
Ponds
Run
Meadow
Pleasant View
Summit
water
(Joins sheet 19)
(Joins sheet 24)
(Joins sheet 31)
LACKAWANNA COUNTY
2 550 000 FEET
2 580 000 FEET
400 000 FEET
390 000 FEET
N
Mile
5 000 Feet
Scale 1:20000



Scale 1:20000

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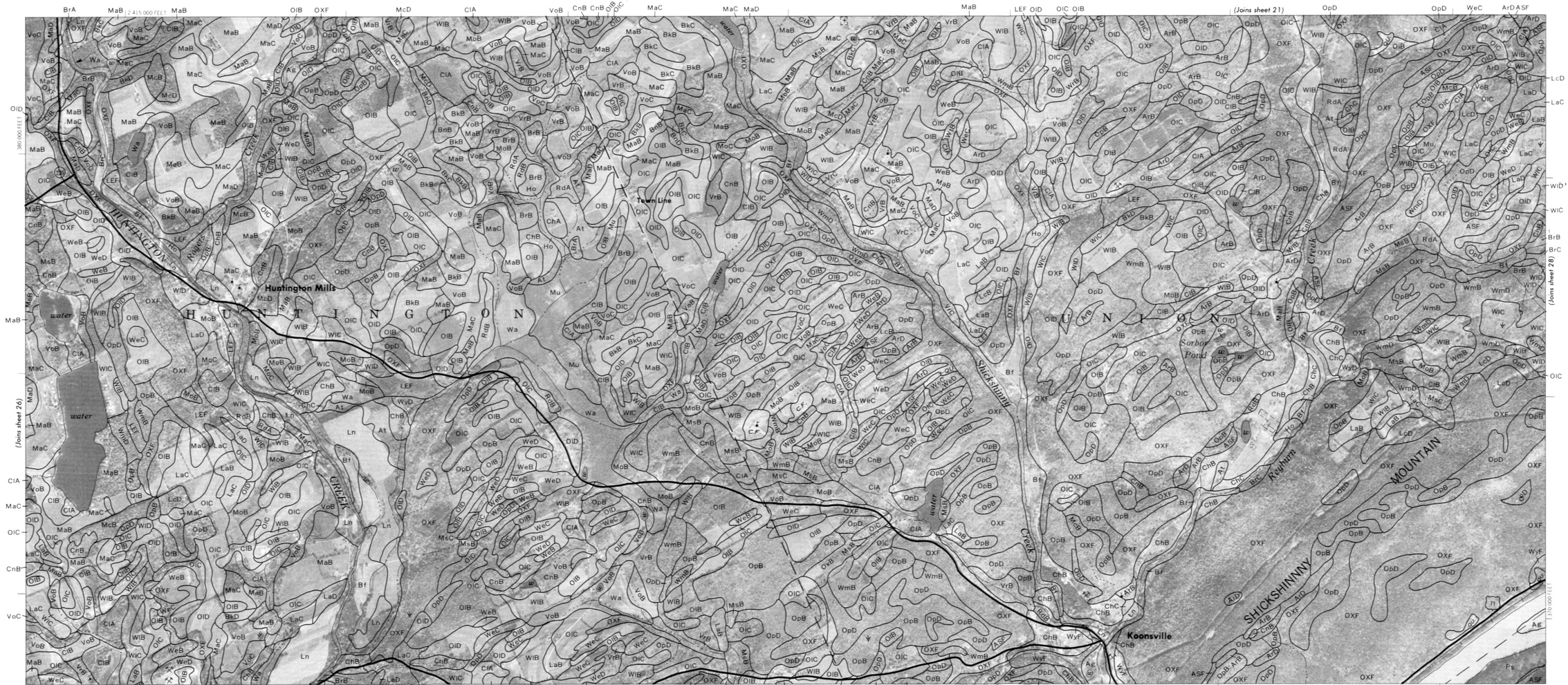
Coordinate grid ticks and boundaries, if shown, are approximately positioned.

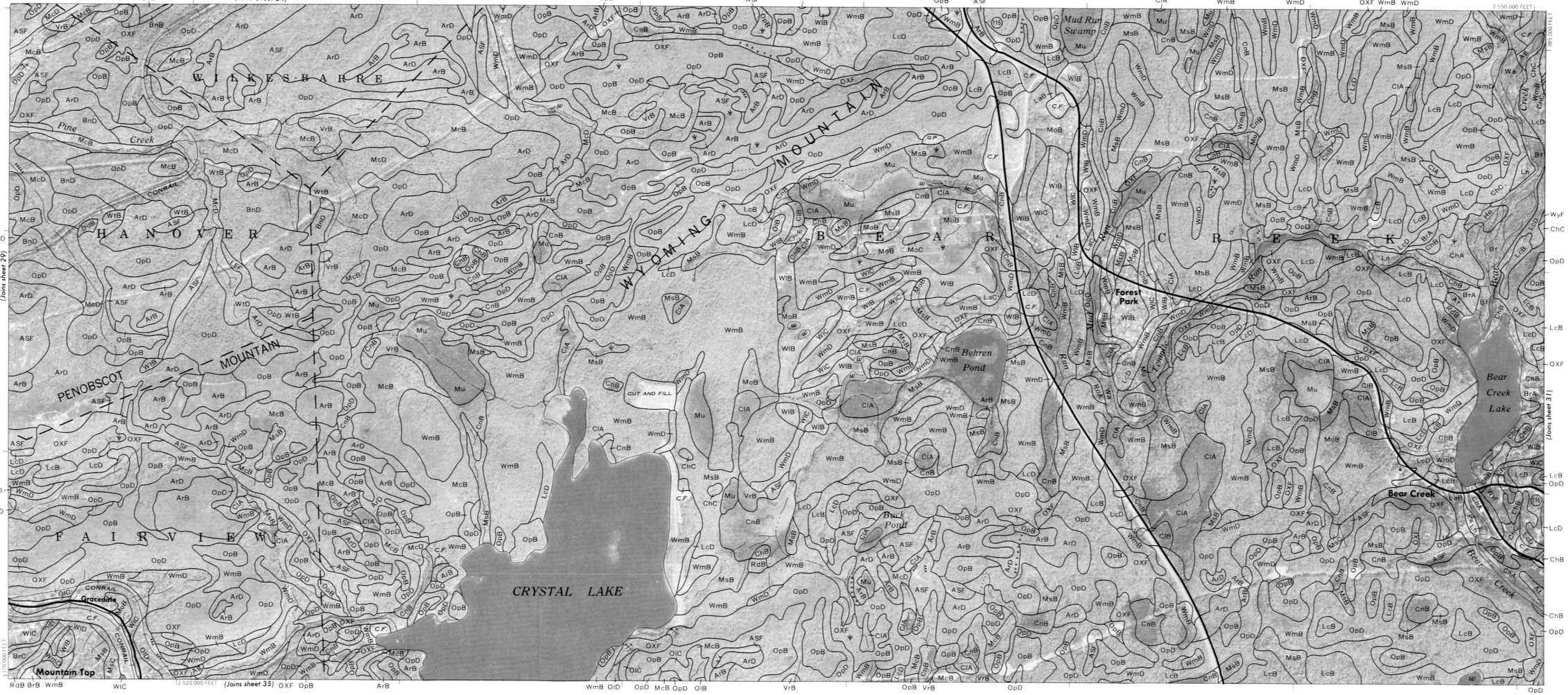
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 27



LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 28

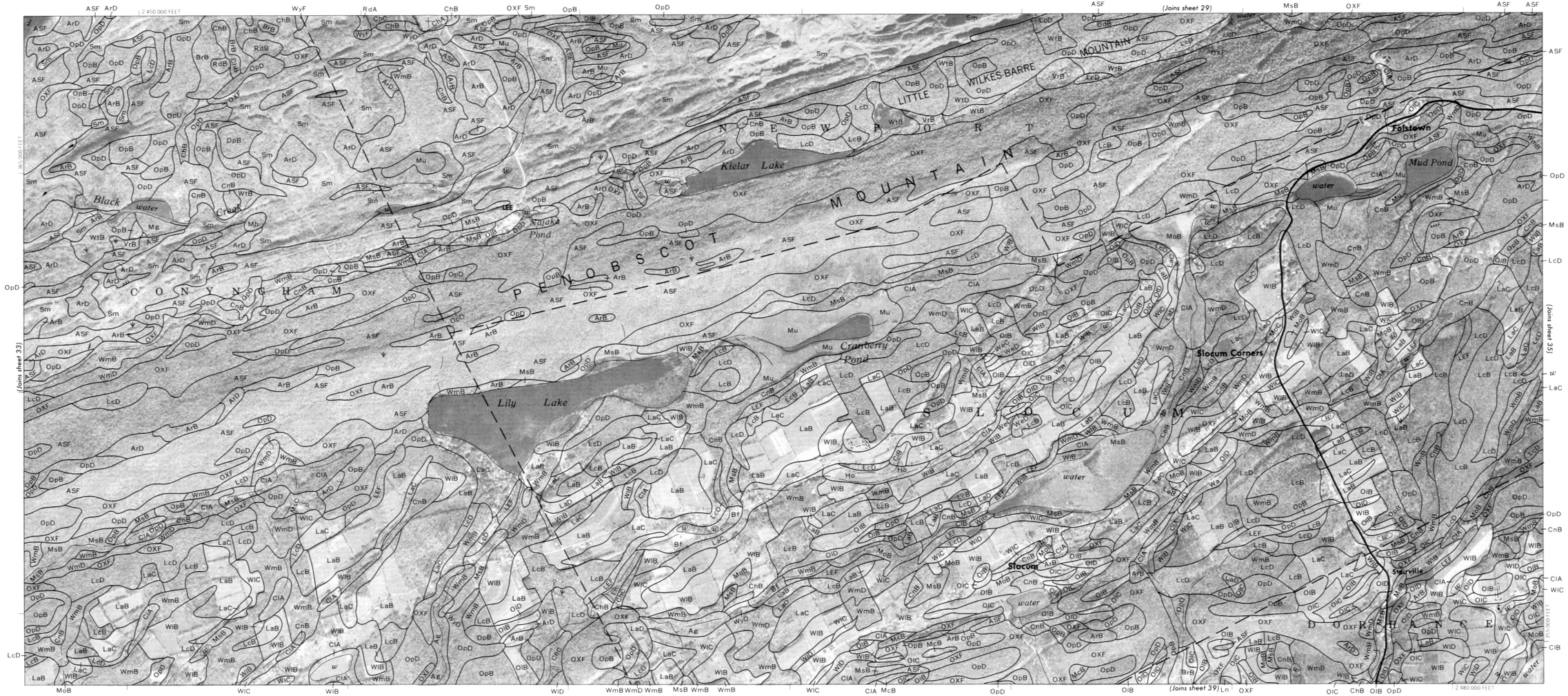
N

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 30

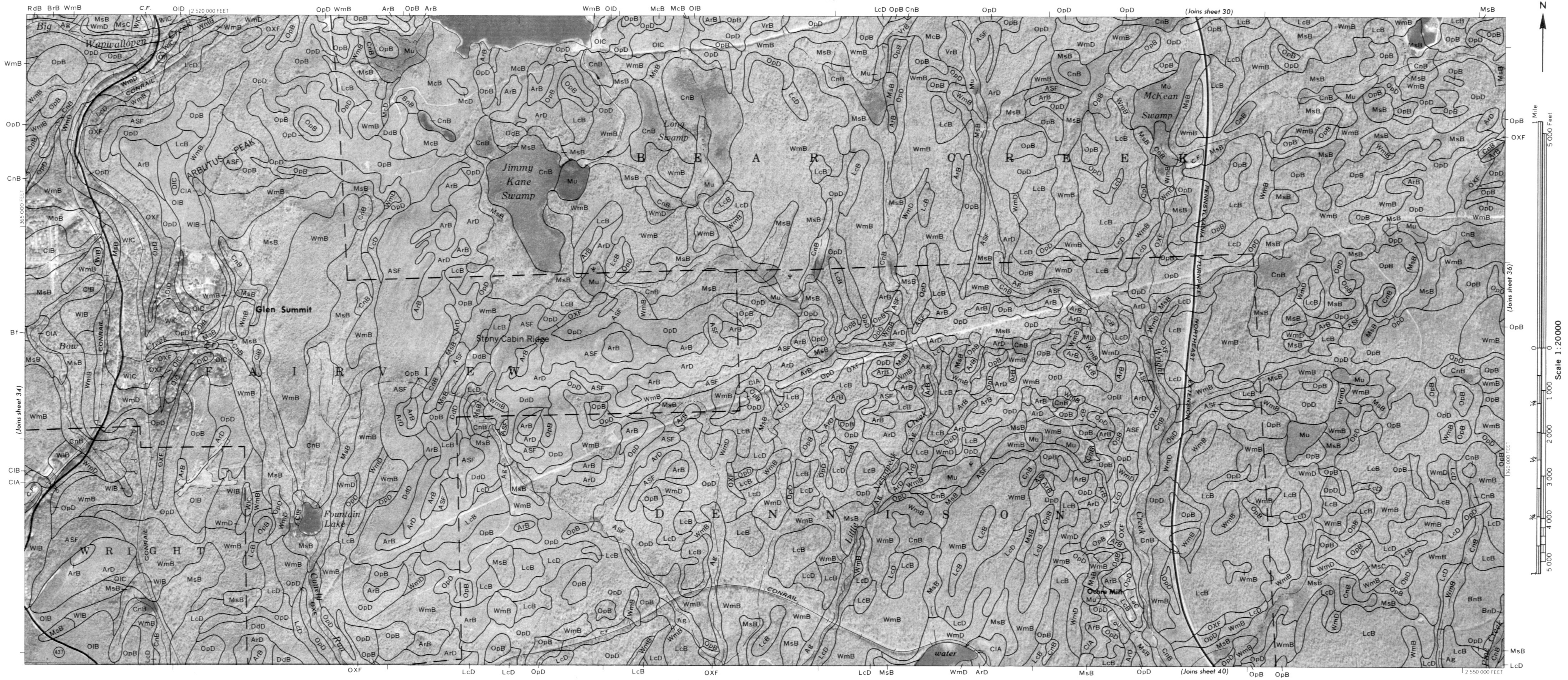


LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 31

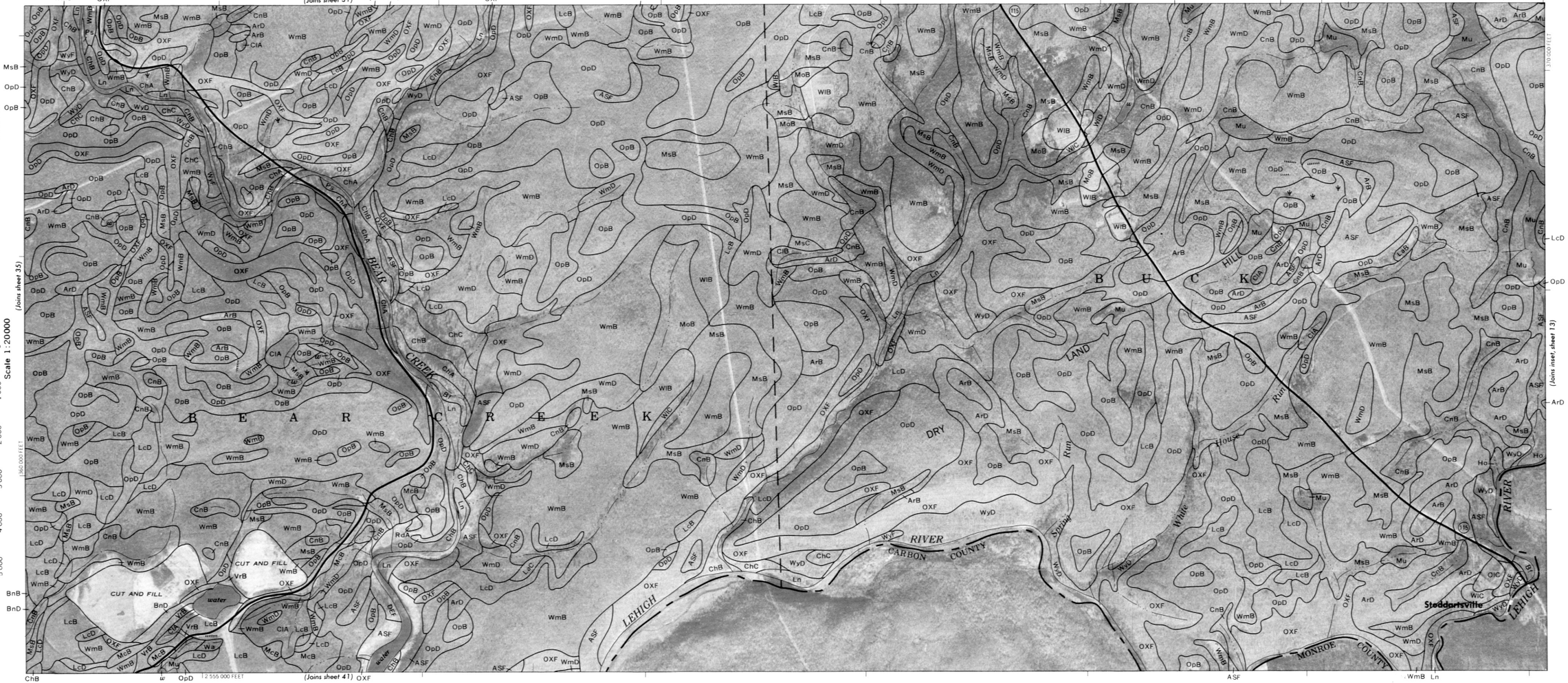
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 32


N
Scale 1:20000
Mile
5,000 feet
(Joins sheet 33)
(Joins sheet 29)
(Joins sheet 35)
(Joins sheet 39)
2 450 000 FEET
2 480 000 FEET
1 805 000 FEET
1 835 000 FEET
CONYNGHAM
PENOBSCOT MOUNTAIN
NEWPORT
LITTLE WILKES-BARRE MOUNTAIN
SUGARLOAF
DORRANCE
Black Creek
water
Kielar Lake
Nuttake Pond
Lily Lake
Cranberry Pond
Mud Pond
Slocum Corners
Slocum
Stairville
Foltstown

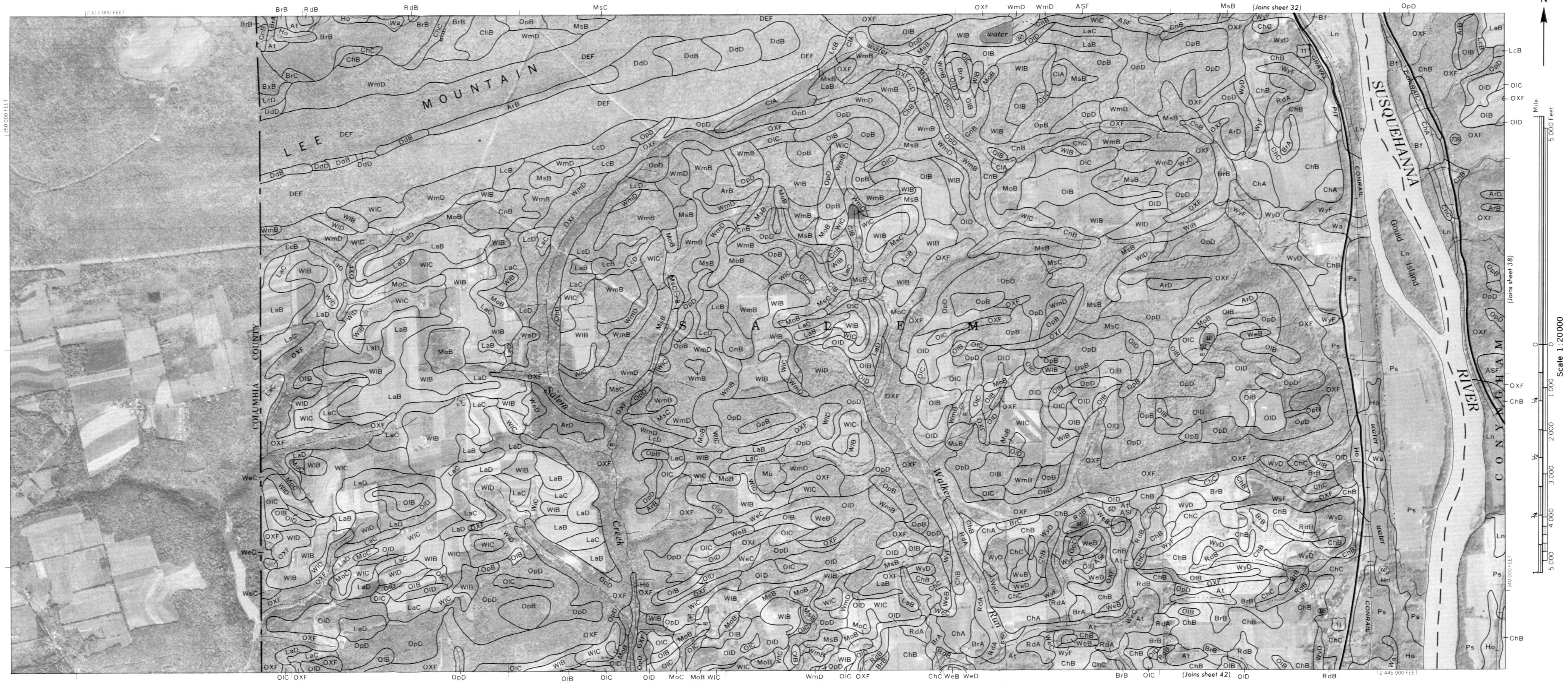
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 34



This map is compiled on 1977 U.S. Geological Survey orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies
Coordinate grid ticks and dashed corners, if shown, are approximately positioned



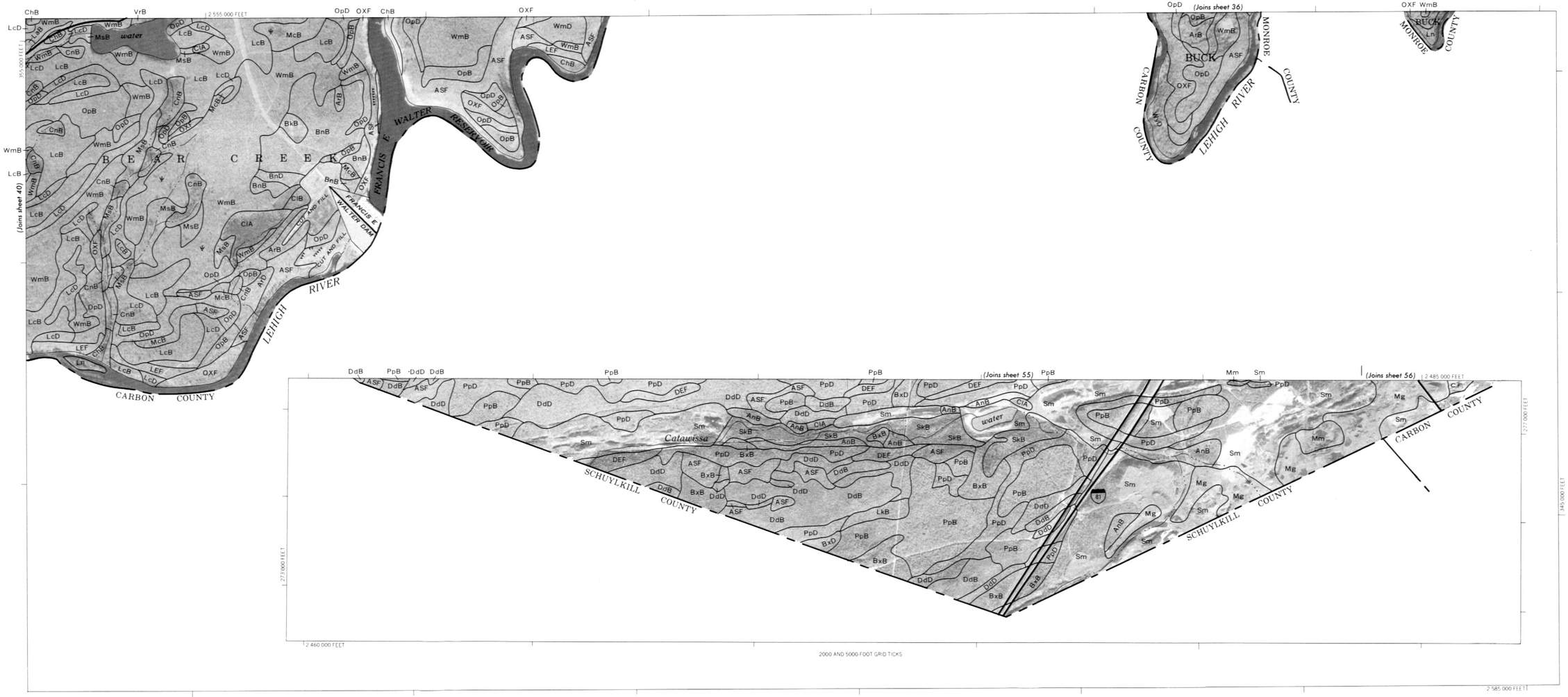
N
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 42)
LEE MOUNTAIN
SALEM
COLUMBIA COUNTY
Salem Creek
Walker Run
SUSQUEHANNA RIVER
Gould Island
CONYNGHAM
CONRAIL
2 415 000 FEET
350 000 FEET
340 000 FEET
2 445 000 FEET
Scale 1:20000

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 38

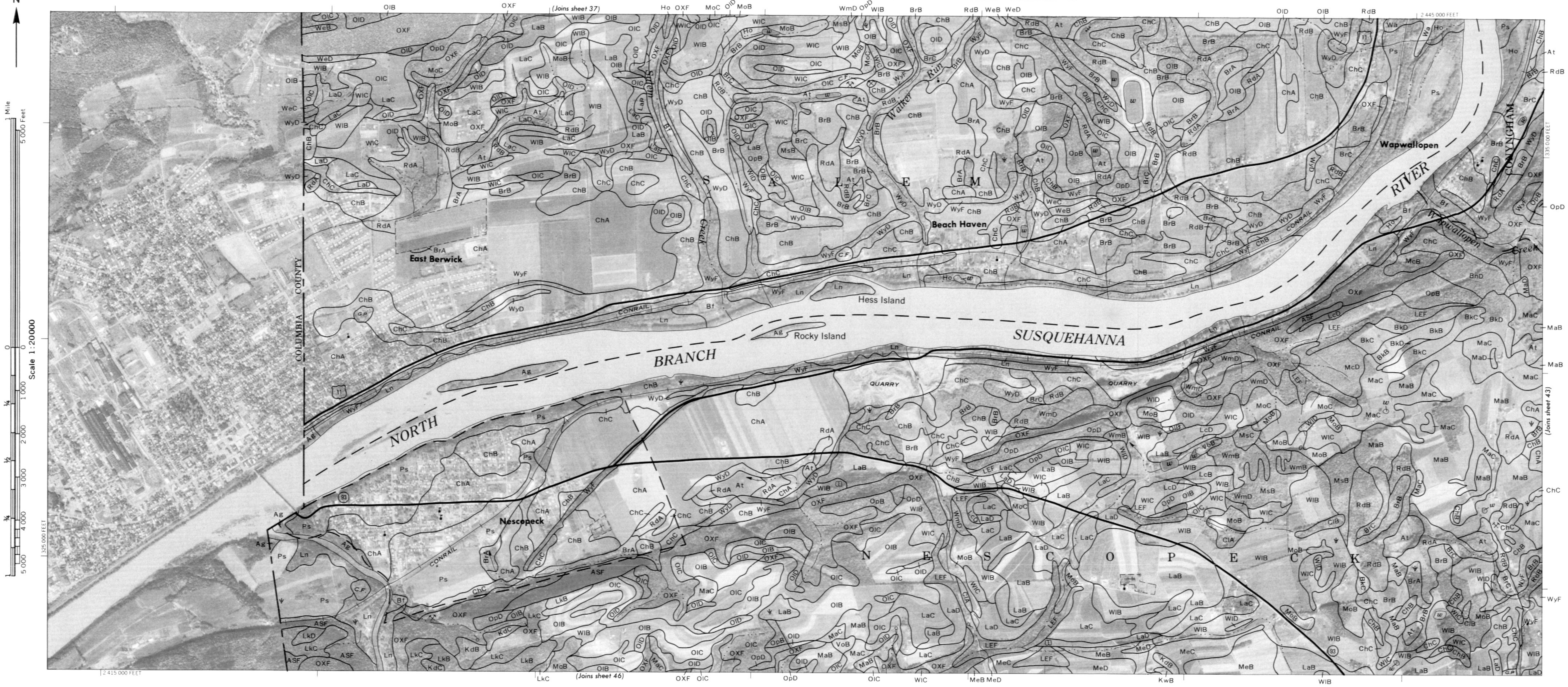
This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.


N
Scale 1:20000
1 Mile
5,000 Feet
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 44)
(Joins sheet 34)
2,485,000 FEET
2,515,000 FEET
350,000 FEET
340,000 FEET
Blythebourn
Rippletown
Albert
Lindbergh
Rita
Reilly
RICE
DORANCE
LITTLE NESCOPECK MOUNTAIN
WRIGHT
DENNISON
BUTLER
Bear Swamp
Watering Run
Big Run
Little Wapwallopen Creek
Wapwallopen Creek
water

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 40



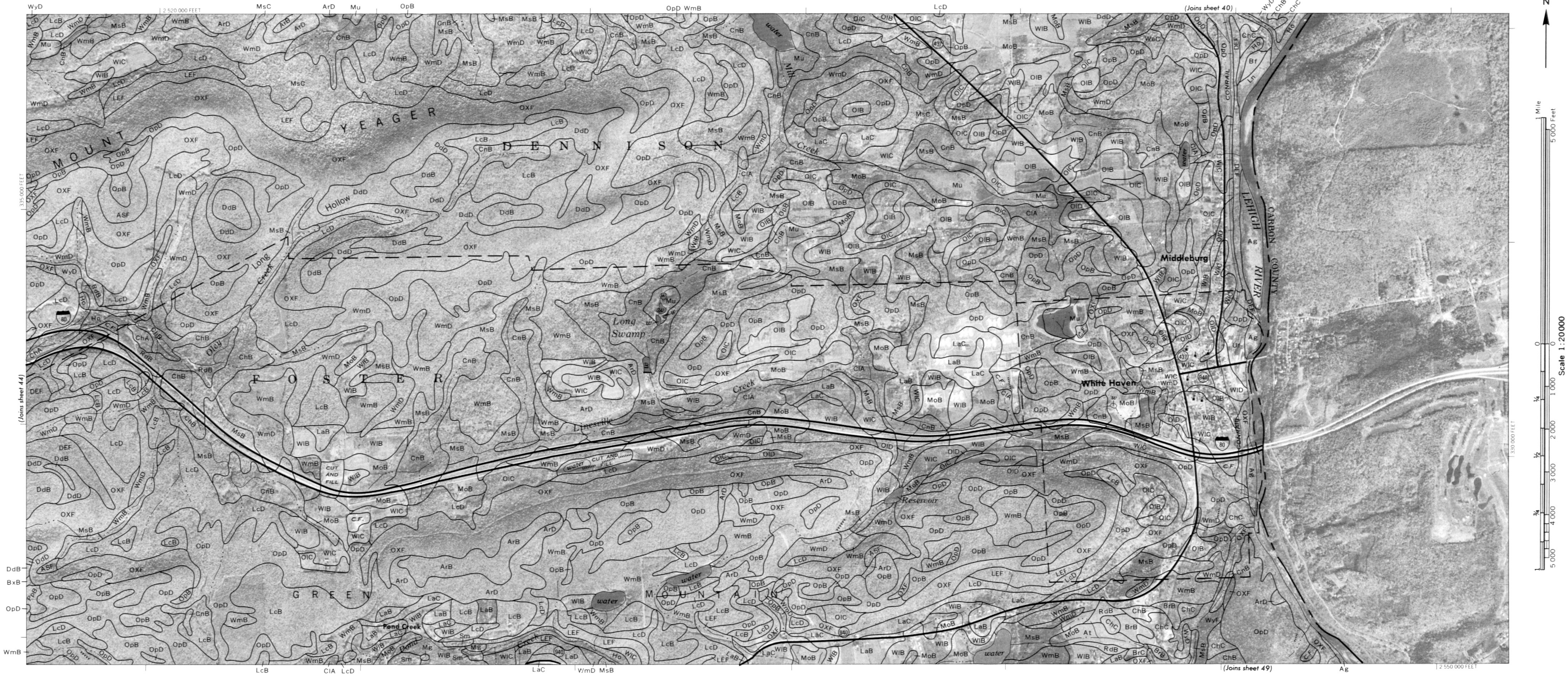
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 42

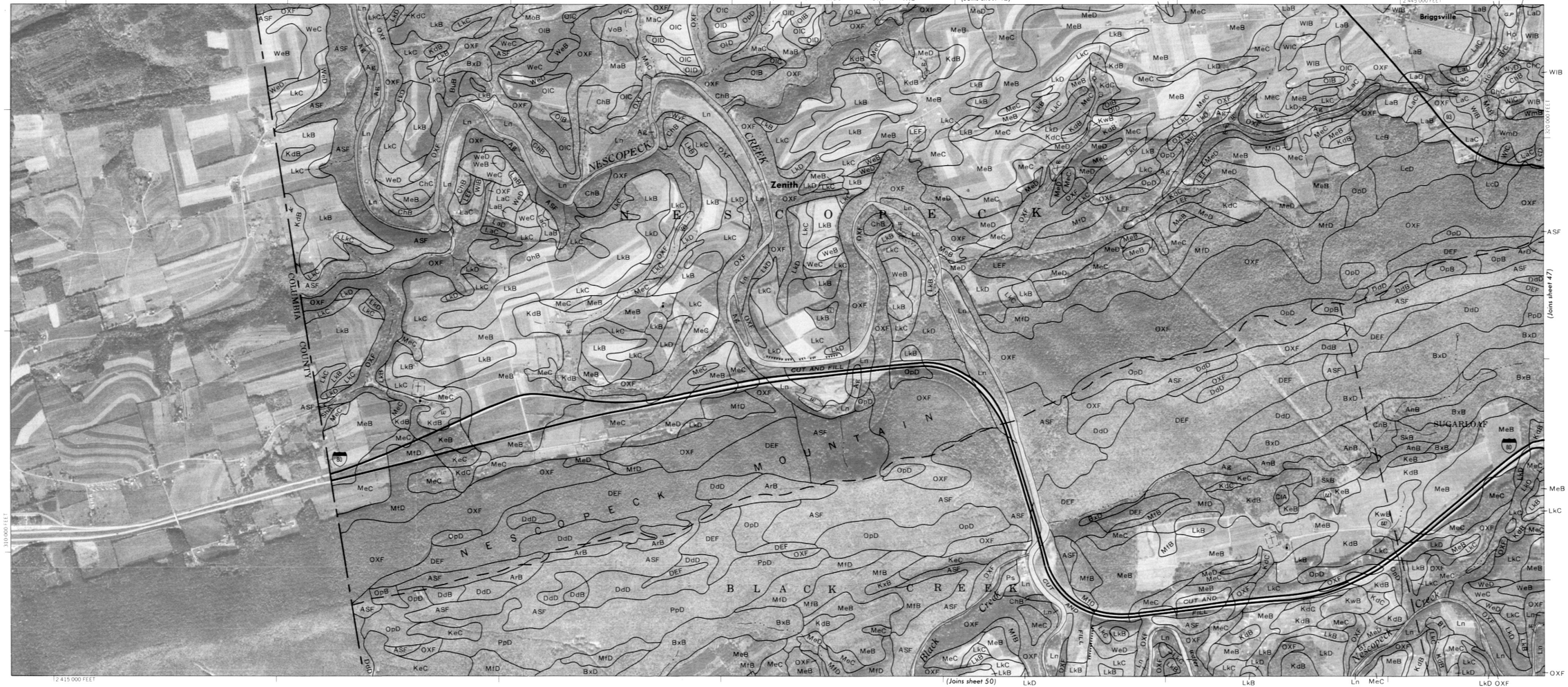



N
Hobbie
Camp Keller
Moyers Grove
Wapwallopen
Creek
HOLLENBACK
MOUNTAIN
NESCOPECK
MOUNTAIN
BUTLER
DORRANCE
SUGARLOAF
CUT AND FILL
(Joins sheet 38)
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 47)
OXF INDEFINITE BOUNDARY
Scale 1:20000
1 Mile
5 000 Feet

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 44

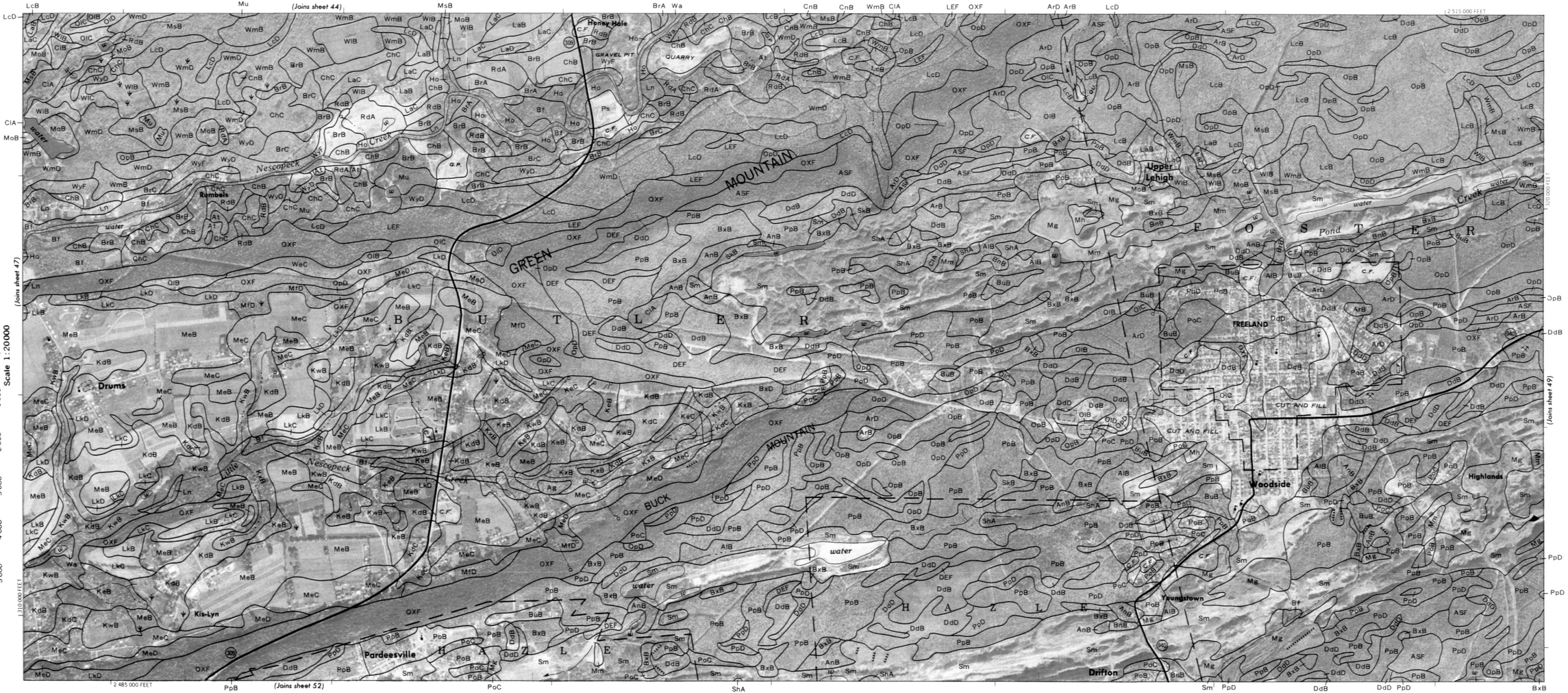
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 45





LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 47

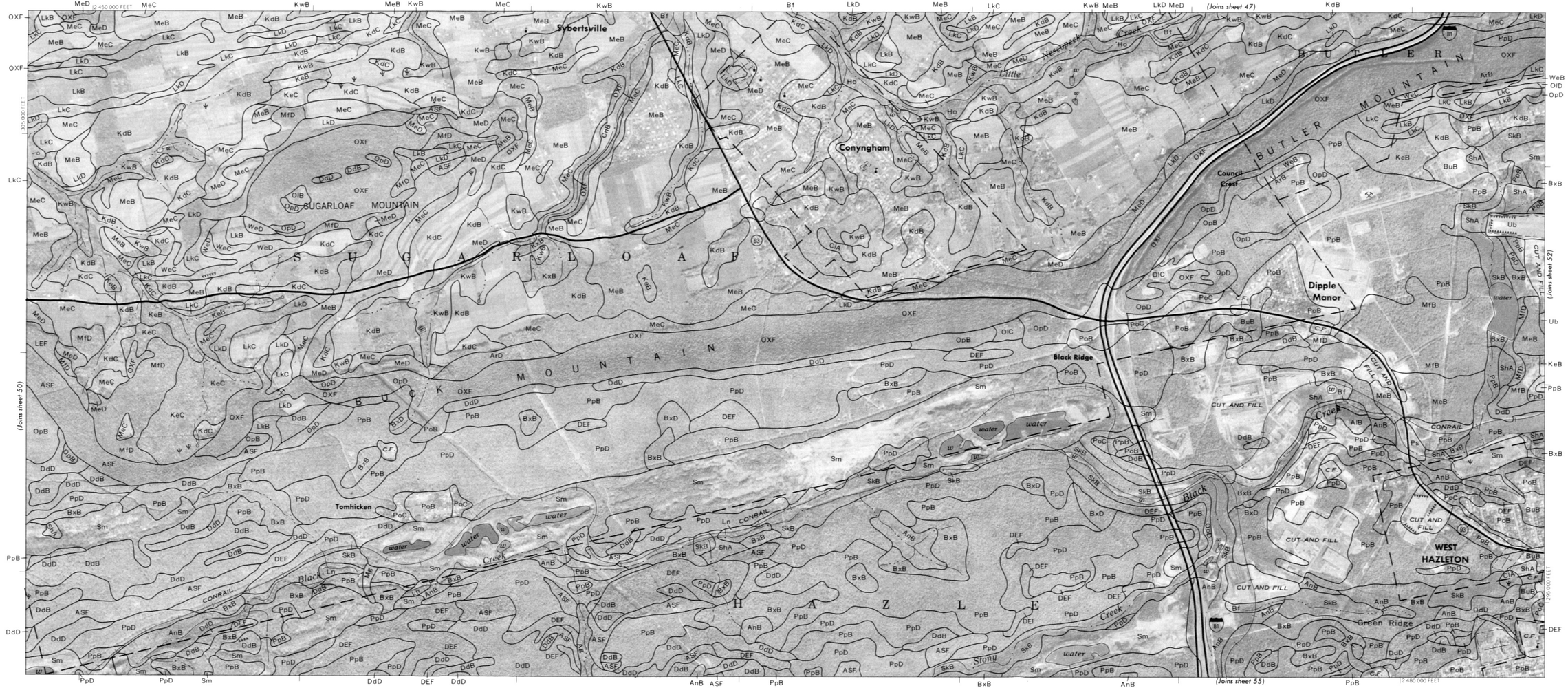
LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 48




N
Scale 1:20000
Mile
5,000 Feet
(Joins sheet 45)
(Joins sheet 48)
(Joins inset, sheet 53)
(Joins sheet 53)
Sandy Run
Sandy Run
Scale Siding
Tonnery
CARBON COUNTY
LEHIGH COUNTY
RIVER
CREEK
FOSTER
MOUNTAIN
BUCK
CARBON CO

N

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 50



LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 52

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 54

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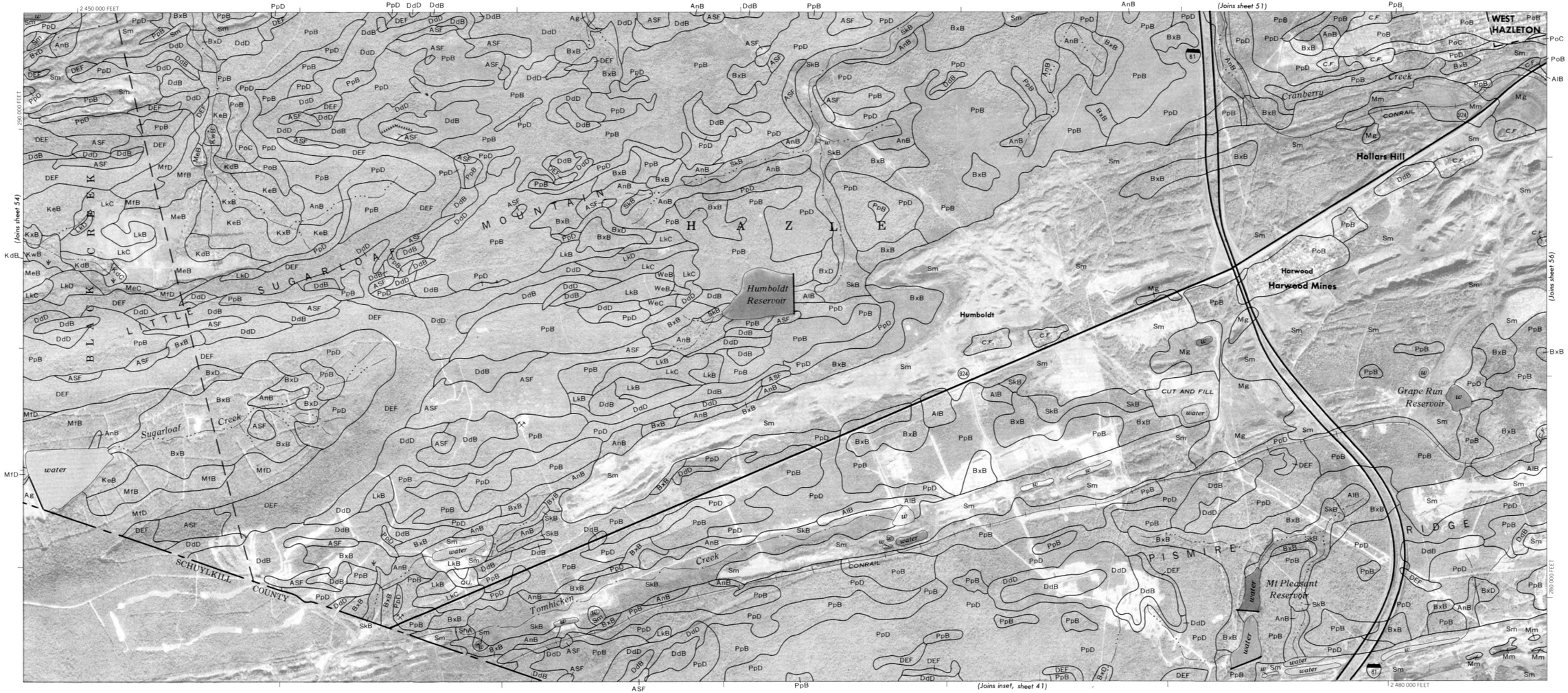

LUZERNE COUNTY, PENNSYLVANIA — SHEET NUMBER 56